

According to Smart Syllabus 2020  
Accelerated Learning Programme (ALP)

**F.Sc**

**12**

**AZEEM**

**10 BOARDS**

**SOLVED PAST PAPERS SERIES**

# CHEMISTRY

**LAHORE**

**GUJRANWALA**

**MULTAN**

**FAISALABAD**

**RAWALPINDI**

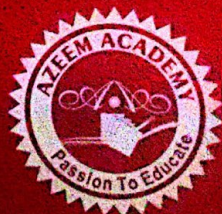
**BAHAWALPUR**

**SARGODHA**

**D.G. KHAN**

**SAHIWAL**

**A.J.K.**





**Solve Past Papers (All Punjab Board)**

★

Periodic Classification of Elements and Periodicity

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## Chapter — 1

### PERIODIC CLASSIFICATION OF ELEMENTS AND PERIODICITY

#### SECTION I

#### Multiple Choice Questions

##### From Exercise:-

1. Keeping in view the size of atoms, which order is the correct one?

- (a)  $Mg > Sr$  (b)  $Ba > Mg$   
(c)  $Lu > Ce$  (d)  $Cl > I$

2. Mark the correct statement:

- (a)  $Na^+$  is smaller than Na atom  
(b)  $Na^+$  is larger than Na atom  
(c)  $Cl^-$  is smaller than Cl atom  
(d)  $Cl^-$  (ion) and Cl (atom) are equal in size

3. Mark the correct statement

- (a) All lanthanides are present in the same group.  
(b) All halogens are present in the same period.  
(c) All the alkali metals are present in the same group.  
(d) All the noble gases are present in the same period.

4. Which statement is incorrect

- (a) All the metals are good conductor of electricity.  
(b) All the metals are good conductor of heat.  
(c) All the metals form positive ions.  
(d) All the metals form acidic oxides.

5. Which statement is correct

- (a) Hydrogen resembles in properties with IA, IVA and VIIA elements.  
(b) Hydrogen resembles in properties with IIIA, IVA and VA elements.  
(c) Hydrogen resembles in properties with IIA, IVA and VIA elements.  
(d) Hydrogen resembles in properties with IIA, IIIA and VIIA elements.

6. Mark the correct statement:

- (a) The ionization energy of calcium is lower than that of barium.  
(b) The ionization energy of calcium is lower than that of magnesium.  
(c) The ionization energy of calcium is higher than that of beryllium.  
(d) The ionization energy of calcium is lower than that of strontium.

7. Mark the correct statement:

- (a) Electron affinity is a measure of energy required to remove the electron.  
(b) Electron affinity is a measure of energy released by adding an electron.  
(c) Electron affinity is a measure of energy required to excite an electron.  
(d) Electron affinity is measure of energy released by removing an electron.

8. Mark the correct statement.

- (a) Metallic character increases down the group.  
(b) Metallic character increases from left to right along a period.  
(c) Metallic character remains the same from left to right along a period.  
(d) Metallic character remains the same down the group.

9. Mark the correct statement:

- (a) Melting points of halogens decrease down the group.  
(b) Melting points of halogens increase down the group.  
(c) Melting points of halogens remain the same throughout the group.  
(d) Melting points of halogens first increase and then decrease down the group

##### II) From Punjab Boards:-

1) Most of the elements are:

- (a) Crystalloids (b) Metals  
(c) Metalloids (d) Non-metals

(LHR-2010)

2) The decrease in atomic sizes is not much prominent across rows containing elements of:

- (a) s-block (b) p-block  
(c) d-block (d) f-block

(LHR-2011)



- 3) How many elements are present in 5<sup>th</sup> period of the periodic table? (LHR-2012-I)  
a) 32                      b) 8  
c) 18                      d) 28
- 4) Elements of the periodic table are classified into blocks: (LHR-2012-II)  
a) four                      b) three  
c) five                      d) six
- 5) Which is the least reactive of all the alkali metals? (LHR-2014-I)  
a) Li                      b) Na  
c) K                      d) Cs
- 6) Potassium oxide is: (GRW-2010)  
a) Acidic                      b) Amphoteric  
c) Basic                      d) Neutral
- 7) Indicate amphoteric oxide: (GRW-2011)  
a) MgO                      b) BeO  
c) SrO                      d) CaO
- 8) The base of modern periodic law is: (GRW-2012)  
a) Electron affinity                      b) Atomic mass  
c) ionization energy                      d) Atomic number
- 9) Which is not an alkali metal? (GRW-13)  
a) Francium                      b) Caesium  
c) Rubidium                      d) Radium
- 10) Smaller the size of an ion: (GRW-2014)  
a) Lesser is the degree of hydration  
b) Lesser is the polarizing power  
c) Greater is the electron affinity  
d) Greater is the degree of hydration
- 11) 6<sup>th</sup> period contains the number of elements: (GRW-2016)  
a) 18                      b) 32  
c) 8                      d) 10
- 12) The strength of binding energy of transition elements depends upon: (GRW-2016)  
a) number of electron pairs  
b) number of unpaired electrons  
c) number of neutrons  
d) number of protons
- 13) Keeping in view the size of atoms, which order is the correct one: (GRW-2017), (DGK-15, 17), (MTN-11, 16, 17, 1-18), (LHR-14, 15), (RWP-17)  
a)  $Mg > Sr$                       b)  $Ba > Mg$   
c)  $Lu > Ce$                       d)  $Cl > I$
- 14) Which of the following statement is correct? (BWP-2014, 2017)  
a)  $Na^+$  atom is smaller than Na atom  
b) Na atom is larger than K atom  
c) F atom is smaller than  $F^-$   
d) F atom is larger than  $F^-$
- 15) Mark the correct statement. (BWP-2014, 2017), (SAH-18), (RWP-II-18)  
a) Metallic character increases down the group  
b) Metallic character increases from left to right along the period  
c) Metallic character remains same from left to right along a period  
d) Metallic character remains same down the group
- 16) Which element form an ion with charge +3: (BWP-2016)  
a) Chromium                      b) Copper  
c) Lead                      d) Zinc
- 17) The number of groups in modern periodic table are: (FSD-2013)  
a) 8                      b) 7  
c) 6                      d) 5
- 18) In periodic table all the non-metals are placed under which of the blocks. (FSD-2015)  
a) f                      b) d  
c) p                      d) s
- 19) Melting points of halogens group: (FSD-2017)  
a) Decrease down the group  
b) increase down the group  
c) Remains same throughout  
d) First increases then decreases
- 20) Which one is an incomplete period? (RWP-2015)  
a) 4<sup>th</sup>                      b) 5<sup>th</sup>  
c) 6<sup>th</sup>                      d) 7<sup>th</sup>



21) Which is the longest period of periodic table?

(RWP-2016)

- a) 4                      b) 5  
c) 6                      d) 7

22) Which of the element gives acidic oxide?

(RWP-2016)

- a) N                      b) As  
c) Sb                      d) Bi

23) Which statement is incorrect? (SGD-13),  
(FSD-18), (BWP-I-18), (DGK-16)

- a) All metals are good conductors of electricity  
b) All metals form acidic oxides  
c) All metals form positive ions  
d) None

24) Which of the following has highest hydration energy? (SGD-2014-15, 19)

- a)  $\text{Li}^{\oplus}$                       b)  $\text{Na}^{\oplus}$   
c)  $\text{K}^{\oplus}$                       d)  $\text{Mg}^{+2}$

25) Which of the following elements has lowest ionization energy? (SGD-2017)

- a) C                      b) Be  
c) B                      d) O

26) Transition elements in 4<sup>th</sup> period are:

(DGK-2011)

- a) 18                      b) 10  
c) 8                      d) 6

27) Hydrogen can be placed at the top of VII A group in periodic table because:

(DGK-2012)

- a) It is electropositive  
b) It can lose electron  
c) It accepts an electron  
d) It forms acidic oxides

28) The basis of modern periodic table is:

(DGK-2014)

- a) Electron affinity      b) Atomic mass  
c) Ionization potential      d) Atomic number

29) Mark the correct statement. (GRW-14),

(MTN-14), (LHR-15, 16),

(SAH-2017), (DGK-18, 19),

- a)  $\text{Na}^+$  is smaller than Na atom  
b)  $\text{Na}^+$  is larger than N a atom  
c)  $\text{Cl}^-$  is smaller than Cl atom  
d)  $\text{Cl}^-$  and Cl are equal

### III) From Entry Test:-

(1) Which of the following elements react with steam only?

- (a) Na                      (b) Mg  
(c) K                      (d) Ca

(2) Which of the following has smallest size?

- (a) Al                      (b)  $\text{Al}^+$   
(c)  $\text{Al}^{++}$                       (d)  $\text{Al}^{+++}$

(3) Which of the following set of elements is not of transition elements?

- (a) Ti, Zn, Hf      (b) Cu, Ag, Au  
(c) Ga, In, Tl      (d) Ni, Pt, Pd

(4) Which of the following is strongest base?

- (a)  $\text{NH}_3$                       (b)  $\text{PH}_3$   
(c)  $\text{AsH}_3$                       (d)  $\text{SbH}_3$

(5) Which pair of atomic numbers represent s-block elements?

- (a) 7, 15                      (b) 6, 12  
(c) 9, 17                      (d) 3, 12

(6) 6<sup>th</sup> period contains transition elements:

- (a) 2                      (b) 8  
(c) 16                      (d) 24

(7) Which of the following properties increases upto the middle of the period and then decreases?

- (a) Ionization energy  
(b) Atomic radii  
(c) Melting and boiling point  
(d) Atomic volume

(8) Which of the following has highest melting point?

- (a) NaCl                      (b) KCl  
(c) RbCl                      (d) CsCl

(9) Which of the following is less basic?

- (a) MnO                      (b)  $\text{MnO}_2$   
(c)  $\text{Mn}_2\text{O}_3$                       (d)  $\text{Mn}_2\text{O}_7$

(10) 7<sup>th</sup> period of the periodic table contains normal elements:

- (a) 2                      (b) 3  
(c) 4                      (d) 8

(11) Periodic table has been divided into blocks, which block contains elements:

- (a) s                      (b) p  
(c) d                      (d) f



- Give the periodic trend of ionization energy and electron affinity in the periodic table. (FSD-2013)
- Give the periodic trend of ionization energy and electron affinity in the periodic table. (RWP-2014)
- What are periods? Discuss various periods of the Periodic Table. (RWP-2017)
- Why is diamond nonconductor while graphite is a good conductor of electricity? (SGD-2017)
- Explain periodic trend in the following physical properties. (DGK-2012), (BWP-18)
- (a) Electron Affinity (b) Ionic Radius
- Describe trend of metallic character in groups and periods and discuss the impact of atomic size on it. (DGK-2014)
- Define ionization energy. Discuss its trend in periods and groups. (SAH-2014), (SGD-13), (DGK-16, -18), (MTN-16), (GRW-17), (LHR-18, 19), (GRW-18)



## Chapter — 2

### S-BLOCK ELEMENTS

#### SECTION I

#### Multiple Choice Questions

##### From Exercise:-

Which one of the following does not belong to alkaline-earth metals?

- (a) Be (b) Ra  
(c) Ba (d) Rn

The oxides of beryllium are

- (a) acidic (b) basic  
(c) amphoteric (d) none of these

Which ion will have the maximum value of heat of hydration?

- (a)  $\text{Na}^+$  (b)  $\text{Cs}^+$   
(c)  $\text{Ba}^{2+}$  (d)  $\text{Mg}^{2+}$

Which one of the following is not an alkali metal?

- (a) Francium (b) Caesium  
(c) Rubidium (d) Radium

5. Which of the following sulphates is not soluble in water?  
(a) Sodium sulphate  
(b) Potassium sulphate  
(c) Zinc sulphate  
(d) Barium sulphate
6. The element caesium bears resemblance with  
(a) Ca (b) Cr  
(c) both of these metals  
(d) none of these metals
7. Chile saltpetre has the chemical formula:  
(a)  $\text{NaNO}_3$  (b)  $\text{KNO}_3$   
(c)  $\text{Na}_2\text{B}_2\text{O}_7$  (d)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
8. The mineral  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  has the general name:  
(a) gypsum (b) dolomite  
(c) calcite (d) Epsom salt
9. Down's cell is used to prepare:  
(a) sodium carbonate  
(b) sodium bicarbonate  
(c) sodium metal  
(d) sodium hydroxide
10. Which element is deposited at the cathode during the electrolysis of brine in diaphragm cell?  
(a)  $\text{H}_2$  (b) Na  
(c)  $\text{Cl}_2$  (d)  $\text{O}_2$

##### (II) From Punjab Boards:-

- 1) The element whose inorganic minerals are not much abundant in earth crust: (LHR-2011)  
(a) Li (b) N  
(c) Na (d) O
- 2) One of the following is applied on walls as white wash: (LHR-2011)  
(a) Lime water (b) Milk of lime  
(c) Milk of magnesia (d) Lime stone
- 3) Which one of the following does not belong to alkaline earth metals?  
(LHR-2012-I, 2017), (DGK-13, 18), (MTN-15, 17, 18), (GRW-15), (FSD-14, 17, 18)  
(a) Be (b) Ra  
(c) Ba (d) Rn



- 4) Dolomite is: (LHR-2012-II)  
 a)  $\text{CaCO}_3$  b)  $\text{MgCO}_3 \cdot \text{CaCO}_3$   
 c)  $\text{MgCO}_3$  d)  $\text{Na}_2\text{CO}_3$
- 5) Which of the following sulphates is not soluble in water? (LHR-2013-I)  
 a) Sodium sulphate  
 b) Potassium sulphate  
 c) Zinc sulphate  
 d) Barium sulphate
- 6) Which is not an alkali metal? (LHR-2012-II), (SGD-13), (DGK-16), (SAH-17), (RWP-18)  
 a) Francium b) Caesium  
 c) Rubidium d) Radium
- 7) Which element has lowest melting point? (LHR-2014-I)  
 a) Beryllium b) Magnesium  
 c) Calcium d) Barium
- 8) Elements of group IA are called: (LHR-2014-II)  
 a) Alkali metals b) Metalloids  
 c) Calcium d) Barium
- 9) The mineral  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  has the general name: (BWP-14), (LHR-2016-I), (MTN-16, 18), (SGD-16)  
 a) Dolomite b) Gypsum  
 c) Calcite d) Epsom salt
- 10) Which ion will have the maximum value of heat of hydration? (FSD-13), (LHR-2017), (GRW-17), (BWP-15, 17)  
 a)  $\text{Na}^+$  b)  $\text{Cs}^{2+}$   
 c)  $\text{Ba}^{2+}$  d)  $\text{Mg}^{2+}$
- 11) The oxides of beryllium are: (GRW-2014)  
 a) Acidic b) Basic  
 c) Amphoteric d) None of these
- 12) Chile saltpeter has the chemical formula: (GRW-2016), (LHR-10, 14, 15, 19), (BWP-14), (DGK-17), (RWP-18)  
 a)  $\text{NaNO}_3$  b)  $\text{KNO}_3$   
 c)  $\text{Na}_2\text{B}_4\text{O}_7$  d)  $\text{Na}_2\text{CO}_3$
- 13) \_\_\_\_\_ elements is not present abundantly in Earth's crust: (MTN-2017)  
 a) Silicon b) Aluminium  
 c) Sodium d) Oxygen

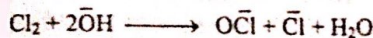
- 14) The element deposited at Cathode during electrolysis of brine in Diaphragm Cell is: (BWP-2016), (FSD-14), (DGK-15), (SGD-16)  
 a)  $\text{Cl}_2$  b) Na  
 c)  $\text{O}_2$  d)  $\text{H}_2$
- 15) Borax has the chemical formula: (BWP-2017)  
 a)  $\text{KNO}_3$  b)  $\text{NaNO}_3$   
 c)  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$  d)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
- 16) Elements of group IIA are called: (FSD-2016)  
 a) Alkali metals  
 b) Alkaline earth metals  
 c) Coinage metals d) Halogens
- 17) The word alkali is derived from which language? (RWP-2016)  
 a) Arabic b) Greek  
 c) French d) German
- 18) Down's cell is used to prepare: (DGK-2017)  
 a) Sodium metal b)  $\text{Na}_2\text{CO}_3$   
 c)  $\text{Na}_2\text{CO}_3$  d)  $\text{NaHCO}_3$
- 19) Beryllium reacts with sodium hydroxide to form: (DGK-2012)  
 a)  $\text{BeO} + \text{NaH}$  b)  $\text{Na}_2\text{BeO}_2 + \text{H}_2$   
 c)  $\text{BeO}_2 + \text{H}_2$  d)  $\text{Be}(\text{OH})_2 + \text{Na}$
- 20) Natron has the chemical formula: (DGK-2015-II)  
 a)  $\text{NaNO}_3$  b)  $\text{KNO}_3$   
 c)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$  d)  $\text{CaCO}_3$

### III) From Entry Tests:-

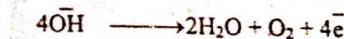
- 1) Magnesium is present in:  
 (a) Ascorbic acid (b) Cyanocobaltamine  
 (c) Chlorophyll (d) Haemoglobin
- 2) What is the composition of Witherite?  
 (a)  $\text{BaSO}_4$  (b)  $\text{BaCO}_3$   
 (c)  $\text{SrSO}_4$  (d)  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
- 3) Which one of the following is not an alkali metal?  
 (a) Fr (b) Cs  
 (c) Rb (d) Ra
- 4) Beryllium metal is as hard as:  
 (a) Fe (b) Cu  
 (c) Zn (d) Diamond



ite  $\text{BaSO}_4$   
**blems During Working of Cells:**  
 urine produced can react with hydroxide ions  
 ag hypochlorite ions.



roxide ions may be attracted towards anode  
 re they can be discharged releasing oxygen  
 which contaminate the chlorine and renders  
 pure.

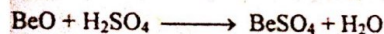


Phosphorite  $\text{Ca}_3(\text{PO}_4)_2$

Chile saltpeter  $\text{NaNO}_3$

erally oxides of metal are basic in nature. In  
 group, the basic character of the oxide  
 eases down the group with increase in the  
 allic character.

ng the 1st member of group IIA, beryllium  
 ws least metallic character in the group.  
 refore,  $\text{BeO}$  is amphoteric in nature and it  
 ts with both acids and bases.



Sodium beryllate

### SECTION III

#### LONG QUESTIONS

scribe the manufacture of  $\text{NaOH}$  by  
 phragm cell. (LHR-2013-II)

ite chemical properties of alkali metals.

(GRW-2010)

at is Nelson's cell? Draw its diagram and  
 ow its working. (GRW-2013), (LHR-12)

scribe commercial method for preparation of  
 lium hydroxide by diaphragm cell.

(MTN-2015), (DGK-18)

scribe commercial preparation of sodium  
 roxide by diaphragm cell. (FSD-2014)

plain the preparation of sodium metal by  
 own's cell. (RWP-14, 15, 16, 18),

(DGK-11), (FSD-13), (BWP-15),

(GRW-11, 15), (MTN-16, II-18), (LHR-17)

many ways. Give four main points of difference.  
 (SGD-2013)

8. Explain peculiar behaviour of Be. (SGD-2016)

9. Give any eight differences of lithium from other  
 alkali metals. (SGD-2017)

10. Write four points of differences between  
 beryllium and its group. (SAH-2014),

(LHR-14, 18), (GRW-14, 18),

(FSD-15), (DGK-15),

(SGD-16, 18), (MTN-17)

11. Discuss the peculiar behaviour of Lithium with  
 respect to the other members of alkali metals  
 (any eight). (SAH-2017), (LHR-13),

(BWP-17), (FSD-17), (SGD-17), (RWP-18)



### Chapter — 3

#### GROUP III A AND GROUP IV A ELEMENTS

#### SECTION I

#### Multiple Choice Questions

##### (b) From Exercise:-

1. Which metal is used in the Thermite process  
 because of its activity?

- (a) Iron (b) Copper  
 (c) Aluminium (d) Zinc

2. Aluminium oxide is:

- (a) Acidic oxide  
 (b) Basic oxide  
 (c) Amphoteric oxide  
 (d) none of these

3. Chemical composition of colemanite is:

- (a)  $\text{Ca}_2\text{B}_6\text{O}_{11} \cdot 5\text{H}_2\text{O}$   
 (b)  $\text{CaB}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$   
 (c)  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$   
 (d)  $\text{CaNaB}_5\text{O}_9 \cdot 8\text{H}_2\text{O}$

4. Which element forms an ion with charge +3?

- (a) Beryllium (b) Aluminium  
 (c) Carbon (d) Silicon



5. Which electronic configuration corresponds to an element of Group-III A of the periodic table:  
 (a)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$   
 (b)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$   
 (c)  $1s^2, 2s^2, 2p^6$   
 (d)  $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$
6. Which element among the following belongs to Group IVA of the periodic table:  
 (a) Barium (b) Iodine  
 (c) Lead (d) Oxygen
7. Boric acid cannot be used:  
 (a) as antiseptic in medicine  
 (b) for washing eyes  
 (c) in soda bottles  
 (d) for enamels and glazes
8. Which of the following elements is not present abundantly in earth's crust?  
 (a) Silicon (b) Aluminium  
 (c) Sodium (d) Oxygen
9. Tincal is a mineral of:  
 (a) Al (b) B  
 (c) Si (d) C
10. The chief ore of aluminium is:  
 (a)  $\text{Na}_3\text{AlF}_6$  (b)  $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$   
 (c)  $\text{Al}_2\text{O}_3$  (d)  $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$

**[II] From Punjab Boards:-**

- 1) Boric acid cannot be used: (LHR-2010), (AJK-16), (BWP-18)  
 (a) as antiseptic in medicine  
 (b) for washing eyes  
 (c) in soda bottles  
 (d) for enamels and glazes
- 2) Which element among the following belongs to Group IV A of the periodic table?  
 (LHR-2013-I)  
 (a) Barium (b) Iodine  
 (c) Lead (d) Oxygen
- 3) Which of the following element has lowest ionization energy?  
 (LHR-2013-II)  
 (a) Beryllium (b) Boron  
 (c) Carbon (d) Oxygen

- 4) Kaolin is a mineral of: (LHR-2014-I)  
 (a) Carbon (b) Magnesium  
 (c) Silicon (d) Aluminium
- 5) Which of the following elements is not present abundantly in earth's crust?  
 (LHR-2017), (MTN-17, 18)  
 (a) Silicon (b) Aluminium  
 (c) Sodium (d) Oxygen
- 6) Basic lead chromate is formed when lead chromate is boiled with: (GRW-2010)  
 (a) Dilute alkali (b) Dilute acid  
 (c) Strong alkali hydroxide (d) Strong acid
- 7) Orthoboric acid when heated to red hot gives: (GRW-2011)  
 (a) Boric anhydride (b) Pyroboric acid  
 (c) Metaboric acid (d) Tetraboric acid
- 8) The chief ore of Aluminium is: (GRW-2015), (SGD-16), (BWP-14), (MTN-18)  
 (a)  $\text{Na}_3\text{AlF}_6$  (b)  $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$   
 (c)  $\text{Al}_2\text{O}_3$  (d)  $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$
- 9) Tincal is a mineral of: (GRW-2016, 2017), (DGK-13), (LHR-12, 16), (BWP-14, 17)  
 (a) Al (b) B  
 (c) Si (d) C
- 10) The element having less than four electrons in its valence shell but it is not a metal:  
 (MTN-2013)  
 (a) B (b) Al  
 (c) Ga (d) In
- 11) Borax has formula: (BWP-2017)  
 (a)  $\text{KNO}_3$  (b)  $\text{NaNO}_3$   
 (c)  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$  (d)  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$
- 12) Which among the following belongs to group IVA of periodic table: (RWP-2017, 18)  
 (a) B (b) Al  
 (c) Ga (d) Tin
- 13) Chemical composition of colemanite is:  
 (SGD-13, 18)  
 (a)  $\text{Ca}_2\text{B}_3\text{O}_7 \cdot 5\text{H}_2\text{O}$  (b)  $\text{Ca}_2\text{B}_4\text{O}_{11} \cdot 5\text{H}_2\text{O}$   
 (c)  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$  (d)  $\text{CaNaB}_3\text{O}_6$
- 14) Which is used in leather industry?  
 (SGD-2014)  
 (a) Borax (b) Boric acid  
 (c) Boric oxide (d) Tetra boric acid



- (5) Which of the following has highest boiling point? (SGD-2014)  
 a) Al b) Si  
 c) P d) S
- (6) Aluminium oxide is: (SGD-2017), (FSD-13), (SAH-18)  
 a) Amphoteric b) Basic  
 c) Acidic d) Neutral
- (7) Which one of following is used in cosmetics? (DGK-2015-II)  
 a) Talc b) Asbestos  
 c) Sodium sulphate d) Aluminium sulphate
- (8) Which element forms an ion with charge +3? (DGK-2016), (MTN-14), (SGD-18)  
 a) Be b) Al  
 c) Si d) C
- (9) Which metal is used in the thermite process because of its activity? (SAH-2017-II), (LHR-13), (GRW-13), (MTN-15, 16), (RWP-15), (FSD-17)  
 a) iron b) copper  
 c) aluminium d) Zinc
- (7) Which metal is used in thermite process because of its activity?  
 (a) Fe (b) Cu  
 (c) Al (d) Zn
- (8) Aluminium oxide is:  
 (a) Acidic (b) Basic  
 (c) Amphoteric (d) None of these
- (9) Which element form an ion with charge +3?  
 (a) Be (b) Al  
 (c) C (d) Si
- (10) Which of the following elements is not present abundantly in earth's crust?  
 (a) Si (b) Al  
 (c) Na (d) O
- (11) Which of the following radicals give blue colour (in cold and hot state) in oxidizing flame when subjected to Borax Bead test?  
 (a)  $\text{Cu}^{+2}$  (b)  $\text{Co}^{+2}$   
 (c)  $\text{Cr}^{+3}$  (d)  $\text{Ni}^{+2}$
- (12) Sulphur is not present in:  
 (a) Onion (b) Garlic  
 (c) Egg (d) Fat
- (13) Which is the formula of clay?  
 (a)  $\text{Al}_2\text{O}_3 \cdot \text{SiF}_4$  (b)  $\text{Al}_2\text{O}_3$   
 (c)  $\text{Na}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$   
 (d)  $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$

**III) From Entry Test:-**

- (1) The colour of cobalt metaborate is:  
 (a) Green (b) Blue  
 (c) Brown (d) Colourless
- (2)  $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$  is formula of:  
 (a) Magnesite (b) Clay  
 (c) Talc (d) Zeolite
- (3) Reaction of dil.  $\text{H}_2\text{SO}_4$  on borax produces:  
 (a)  $\text{HBO}_2$  (b)  $\text{B}_2\text{O}_3$   
 (c)  $\text{H}_3\text{BO}_3$  (d)  $\text{H}_2\text{B}_4\text{O}_7$
- (4) If saturated solution of Borax is allowed to crystallize above  $62^\circ\text{C}$ , crystals obtained are:  
 (a) Decahydrate (b) Pentahydrate  
 (c) Heptahydrate (d) Anhydrous
- (5)  $\text{H}_3\text{BO}_3$  is crystalline substance. Its shape is:  
 (a) Hexagonal (b) Monoclinic  
 (c) Triclinic (d) Cubic
- (6) Al is less dense than iron:  
 (a) Two times (b) Three times  
 (c) Four times (d) Five times

- (14)  $\text{BF}_3$  acts as Lewis acid because it behaves as:  
 (a) Free radical (b) Cationic specie  
 (c) Electrophile (d) Nucleophile
- (15) Elements which exhibits maximum catenation property:  
 (a) C (b) Pb  
 (c) Ge (d) Sn

**SECTION II****SHORT QUESTIONS****From Exercise:-****QUESTIONS**

- What is the action of an aqueous solution of borax on litmus?
- Give equations to represent the following reactions.  
 (a) Borax is heated with  $\text{CoO}$   
 (b)  $\text{Al}_2\text{O}_3$  is heated with  $\text{NaOH}$  solution
- Why is aluminum not found as a free element?



## Chapter — 4

GROUP VA AND GROUP VI A  
ELEMENTS

## SECTION I

## Multiple Choice Questions

## D From Exercise:-

- Out of all the elements of group VA, the highest ionization energy is possessed by  
(a) N (b) P  
(c) Sb (d) Bi
- Among group VA elements, the most electronegative element is  
(a) Sb (b) N  
(c) P (d) As
- Oxidation of NO in air produces  
(a)  $N_2O$  (b)  $N_2O_3$   
(c)  $N_2O_4$  (d)  $N_2O_5$
- The brown gas formed, when metal reduces  $HNO_3$  to  
(a)  $N_2O_5$  (b)  $N_2O_3$   
(c)  $NO_2$  (d)  $NO$
- Laughing gas is chemically  
(a)  $NO$  (b)  $N_2O$   
(c)  $NO_2$  (d)  $N_2O_4$
- Out of all the elements of group VIA, the highest melting and boiling points is shown by the element  
(a) Te (b) Se  
(c) S (d) Pb
- $SO_3$  is not absorbed in water directly to form  $H_2SO_4$  because  
(a) The reaction does not go to completion.  
(b) The reaction is quite slow.  
(c) The reaction is highly exothermic.  
(d)  $SO_3$  is insoluble in water.
- Which catalyst is used in contact process?  
(a)  $Fe_2O_3$  (b)  $V_2O_5$   
(c)  $SO_3$  (d)  $Ag_2O$
- Which of the following specie has the maximum number of unpaired electrons?  
(a)  $O_2$  (b)  $O_2^+$   
(c)  $O_2^{-1}$  (d)  $O_2^{-2}$

## II From Punjab Boards:-

- At  $18^\circ C$  the specific gravity of  $H_2SO_4$  is:  
(LHR-2010)  
(a) 1.891 (b) 1.834  
(c) 2.101 (d) 1.740
- Among group V A elements, the most electronegative is:  
(LHR-2012-I),  
(SGD-13), (RWP-15), (MTN-16), (FSD-17)  
(a) Sb (b) N  
(c) P (d) As
- When sugar is treated with conc.  $H_2SO_4$  it becomes black due to:  
(LHR-2013-I)  
(a) Decolourization (b) Dehydration  
(c) Hydrolysis (d) Hydration
- Laughing gas is chemically:  
(LHR-2013-II, 2019),  
(FSD-13), (BWP-15), (DGK-16, 18),  
(GRW-13, 17), (SAH-18), (SGD-18)  
(a)  $NO$  (b)  $N_2O$   
(c)  $NO_2$  (d)  $N_2O_4$
- Which of the following is a reddish brown gas?  
(LHR-2014-I), (GRW-14),  
(AJK-16), (SAH-17)  
(a)  $N_2O$  (b)  $NO$   
(c)  $N_2O_5$  (d)  $NO_2$
- Oxidation of  $NO$  in air produces:  
(LHR-2016-I),  
(MTN-17, 18), (SGD-18)  
(a)  $N_2O$  (b)  $N_2O_3$   
(c)  $N_2O_4$  (d)  $N_2O_5$
- Which catalyst is used in contact process?  
(LHR-2017), (FSD-15), (SGD-16, 17),  
(GRW-13, 16), (BWP-14), (SAH-18)  
(a)  $Fe_2O_3$  (b)  $V_2O_5$   
(c)  $SO_3$  (d)  $Ag_2O$
- Active nitrating agent during nitration is:  
(GRW-2010)  
(a)  $NO_3$  (b)  $NO_2^+$   
(c)  $NO_2$  (d)  $HNO_3$
- The highest ionization energy is possessed by:  
(GRW-2011)  
(a) Nitrogen (b) Phosphorus  
(c) Bismith (d) Antimony



- 1) Which halogen will react spontaneously with Au (s) to produce  $Au^{3+}$ ? (GRW-2014)
- a)  $Br_2$                       b)  $F_2$   
c)  $I_2$                         d)  $Cl_2$
- 2) The most reactive allotropic form of phosphorus is: (MTN-2014)
- a) White                      b) Red  
c) Black                      d) None
- 3) The brown gas formed, when metal reduces  $HNO_3$  is: (MTN-2015), (RWP-18), (MTN-18)
- a)  $N_2O_5$                       b)  $N_2O_3$   
c)  $NO_2$                         d)  $NO$
- 4) Which of the following contain 48% oxygen? (BWP-2014)
- a)  $SiO_2$                         b)  $BaCO_3$   
c)  $CaCO_3$                       d)  $H_2O_2$
- 5) Which metal is rendered passive by  $HNO_3$ ? (SGD-2014)
- a) Pt                            b) Sn  
c) Al                            d) Mn
- 6)  $NO_2$  is called: (DGK-2011)
- a) Nitrogen peroxide  
b) Nitrous oxide  
c) Nitric oxide  
d) Nitric anhydride
- 7) Aqua regia contains  $HNO_3$  and  $HCl$  in the ratio of (DGK-2012)
- a) 1:1                          b) 1:2  
c) 1:3                          d) 3:1
- 8) What is %age of calcium phosphate in bone ash? (DGK-2015-II)
- a) 20                            b) 40  
c) 60                            d) 80
- 9) Which of the following specie has the maximum number of unpaired electrons? (DGK-2017)
- a)  $O_2$                             b)  $O_2^+$   
c)  $O_2^{-1}$                           d)  $O_2^{-2}$

**From Entry Test:-**

Dehydration of formic acid in the presence of  $Al_2O_3$  produces:

- a)  $CO_2 + H_2$                       b)  $CO + H_2O$   
c)  $CO + CO_2$                       d) None

- (2) When powdered sulphur is heated, it melts to a mobile liquid. On further heating, this liquid changes into a thick substances. The best explanation for the second change is:
- a) Formation of  $S_8$  ring of sulphur atoms  
b) Breaking of  $S_8$  molecules and formation of chains of s-atoms  
c) Change of  $S_8$  molecule to s-atoms  
d) Change of s-atoms to  $S_8$  molecules
- (3) Formula of fuming sulphuric acid is:
- a)  $H_2SO_4$                       b)  $H_2SO_3$   
c)  $H_2SO_4 + SO_3$                       d) None
- (4) Nitrogen is chemically inert to all atoms at room temperature except:
- a) Mg                            b) Ca  
c) Al                            d) Li
- (5) Which form of Phosphorus is more stable?
- a) White                        b) Red  
c) Black                        d) All
- (6) Fuming nitric acid contains excess of:
- a)  $NO$                             b)  $NO_2$   
c)  $N_2O_3$                         d)  $N_2O_5$
- (7) Which has the lowest boiling point?
- a)  $NH_3$                             b)  $PH_3$   
c)  $AsH_3$                         d)  $SbH_3$
- (8) Conversion of white  $P_4$  to red P is accelerated in the presence of:
- a) Fe                            b) Ni  
c)  $Br_2$                             d)  $I_2$
- (9) Which of the gas cannot be dried over conc.  $H_2SO_4$ ?
- a)  $SO_2$                             b)  $N_2$   
c)  $NH_3$                             d)  $H_2$
- (10) Chemical composition of Fool's gold is:
- a)  $FeS$                             b)  $FeS_2$   
c)  $Fe_2S_3$                         d)  $HgS$
- (11) Which one the following elements occur free in nature?
- a) Sb                            b) As  
c) N                            d) P
- (12) Which one of the following compounds is not known?
- a)  $SbCl_3$                         b)  $NCl_3$   
c)  $Nl_3$                             d)  $NCl_5$



- (13) Yellow colour of Nitric acid is due to the presence of:  
 (a)  $\text{NO}_2$  (b)  $\text{NO}$   
 (c)  $\text{N}_2\text{O}$  (d)  $\text{N}_2\text{O}_4$
- (14) Gold dissolved in Aqua regia to give:  
 (a)  $\text{AuCl}_2$  (b)  $\text{AuCl}$   
 (c)  $\text{AuCl}_3$  (d) None
- (15) When red phosphorus is heated with  $\text{HNO}_3$  it forms:  
 (a)  $\text{H}_3\text{PO}_4$  (b)  $\text{HPO}_2$   
 (c)  $\text{H}_3\text{PO}_3$  (d)  $\text{H}_3\text{PO}_2$
- (16) Which of the following is used at the tips of match stick?  
 (a)  $\text{K}_2\text{Cr}_2\text{O}_7 + \text{S} + \text{White P}$   
 (b)  $\text{K}_2\text{Cr}_2\text{O}_7 + \text{K} + \text{S}$   
 (c)  $\text{S}$  and  $\text{K}$  (d)  $\text{Sb}_2\text{S}_3$
- (17) What is the number of electrons present in the valence shell of P in  $\text{PCl}_3$ ?  
 (a) 4 (b) 6  
 (c) 8 (d) 2

## SECTION II

### SHORT QUESTIONS

**From Exercise:-**

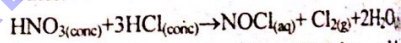
#### QUESTIONS

- How does nitrogen differ from other elements of its group?
- Why does aqua regia dissolve gold and platinum?
- Why the elements of group VIA other than oxygen show more than two oxidation states?
- Write down a comparison of the properties of oxygen and sulphur.
- Write down the equation for the reaction between conc.  $\text{H}_2\text{SO}_4$  and copper and explain what type of reaction is it.
- Which metals evolve hydrogen upon reaction with nitric acid? Illustrate along with chemical equations.
- What is meant by fuming nitric acid?
- Give the advantages of contact process for the manufacture of sulphuric acid.
- Why is  $\text{SO}_3$  dissolved in  $\text{H}_2\text{SO}_4$  and not in water?
- Describe "Ring test" for the confirmation of the presence of nitrate ions in solution.
- $\text{NO}_2$  is a strong oxidizing agent. Prove the truth of this statement giving examples.

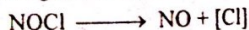
- Nitrogen differ from other elements of its group in following properties.
  - Nitrogen is a gas while other elements are solids.
  - Nitrogen have no allotropic forms while other elements have allotropes.
  - The valence shell of nitrogen is restricted to octet due to absence of d-orbitals, while other can accommodate more than 8 electrons due to presence of d-orbitals.
  - Nitrogen occur in free state in air, while other elements cannot exist in free state.
  - Due to greater electronegativity of nitrogen its hydride ( $\text{NH}_3$ ) is capable of forming hydrogen bonding. It is not present as hydrides of other elements of the group.

#### 2. Aqua Regia:

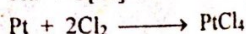
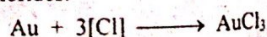
A solution obtained by mixing one volume concentrated  $\text{HNO}_3$  and three volumes concentrated  $\text{HCl}$  is called aqua regia or R. water.



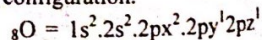
Aqua regia is employed to dissolve gold and platinum. The  $\text{NOCl}$  present in aqua regia decompose to give  $\text{NO}$  and  $\text{Cl}_2$ .



The liberated chlorine gas converts noble metals such as gold and platinum into their soluble chlorides.



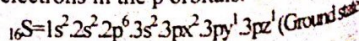
- Oxygen with atomic number 8 have following electronic configuration.



Due to non availability of d-orbitals, the valence shell of oxygen is restricted to octet. Hence oxygen shows oxidation state  $\pm 2$ , as it has no unshared electrons.

Except oxygen the other member of group 16 show more than two oxidation states i.e.  $+2$ ,  $+4$  and  $+6$  due to presence of empty d-orbitals.

❖  $+2$  oxidation state is shown due to 2 unpaired electrons in the p orbitals.





Describe Birkeland and Eyde's process for the manufacture of nitric acid. (LHR-2015-II),

(FSD-15), (MTN-15), (DGK-15)

How is nitric acid prepared industrially? Give all equations involved. (DGK-2015)

Give four reactions of  $\text{H}_2\text{SO}_4$  as an acid.

(RWP-2015)

How Sulphuric acid is manufactured by contact process on industrial scale? (RWP-2016)

Write equations of the reactions of conc.  $\text{HNO}_3$  with  $\text{HI}$ ,  $\text{Sn}$ ,  $\text{Cu}$ ,  $\text{Zn}$ . (SGD-2015)

$\text{H}_2\text{SO}_4$  acts as an oxidizing agent and dehydrating agent. Support your answer with two examples each. (DGK-2015)



## Chapter — 5

### THE HALOGENS AND THE NOBLE GASES

#### SECTION I

#### Multiple Choice Questions

##### From Exercise:-

Which of the following hydrogen halide is the weakest acid in solution?

- (a) HF (b) HBr  
(c) HI (d) HCl

Chlorine heptaoxide ( $\text{Cl}_2\text{O}_7$ ) reacts with water to form:

- (a) Hypochlorous acid (b) Chloric acid  
(c) Perchloric acid (d) Chlorine and oxygen

Hydrogen bond is the strongest between the molecules of:

- (a) HF (b) HCl  
(c) HBr (d) HI

Which halogen will react spontaneously with  $\text{Au(s)}$  to produce  $\text{Au}^{3+}$ ?

- (a)  $\text{Br}_2$  (b)  $\text{F}_2$   
(c)  $\text{I}_2$  (d)  $\text{Cl}_2$

The anhydride of  $\text{HClO}_4$  is?

- (a)  $\text{ClO}$  (b)  $\text{ClO}_2$   
(c)  $\text{Cl}_2\text{O}_3$  (d)  $\text{Cl}_2\text{O}_7$

6. Bleaching powder may be produced by passing chlorine over

- (a) Calcium carbonate  
(b) hydrated calcium sulphate  
(c) Anhydrous calcium sulphate  
(d) Calcium hydroxide  
(e) Magnesium hydroxide

7. Which is the strongest acid?

- (a)  $\text{HClO}$  (b)  $\text{HClO}_2$   
(c)  $\text{HClO}_3$  (d)  $\text{HClO}_4$

8. Which halogen occurs naturally in a positive oxidation state?

- (a) Fluorine (b) Chlorine  
(c) Bromine (d) Iodine

9. An element that has a high ionization energy and tends to be chemically inactive would most likely to be:

- (a) an alkali metal  
(b) a transition element  
(c) a noble gas  
(d) a halogen

10. Which of the following represents the correct electronic configuration of the outermost energy level of an element of zero (VIII A) group in the ground state?

- (a)  $s^2p^2$  (b)  $s^2p^4$   
(c)  $s^2p^5$  (d)  $s^2p^6$

##### II) From Punjab Boards:-

1) Which one is true about melting points of halogens? (LHR-2013-I)

- (a) Decrease down the group  
(b) Increase down the group  
(c) Remain same in group  
(d) First increase then decrease down the group

2) Which hydrogen halide is the weakest acid in solution? (LHR-2013-II), (FSD-14), (BWP-14, 15), (AJK-16), (DGK-16, 18), (MTN-16), (SGD-17, 18), (GRW-18)

- (a) HF (b) HBr  
(c) HI (d) HCl



3) Which of the following statement is correct?

(LHR-14-I)

- Bond energy of  $F_2$  is less than  $Cl_2$
  - Bond energy of  $F_2$  is less than  $I_2$
  - Bond energy of  $Cl_2$  is less than  $F_2$
  - Bond energy of  $Cl_2$  is less than  $Br_2$
- 4) Which halogen occurs naturally in a positive oxidation state? (BWP-14), (GRW-10), (LHR-2016-I, 2017),
- Fluorine
  - Chlorine
  - Bromine
  - Iodine
- 5) The strongest acid is: (GRW-2011)
- HF
  - HBr
  - HCl
  - HI
- 6) The anhydride of  $HClO_4$  is: (BWP-2017), (LHR-13), (GRW-16, 17), (DGK-17), (MTN-17, 18), (BWP-18)
- $ClO_3$
  - $ClO_2$
  - $Cl_2O_5$
  - $Cl_2O_7$
- 7) Which is the strongest acid? (DGK-13, 15), (FSD-2015, 2017, 18), (SGD-13, 15, 19), (LHR-14, 15), (SAH-18), (RWP-18)
- $HClO$
  - $HClO_2$
  - $HClO_3$
  - $HClO_4$
- 8) Which halogen will react spontaneously with  $Au(s)$  to produce  $Au^{3+}$ ? (RWP-2017)
- $Br_2$
  - $F_2$
  - $I_2$
  - $Cl_2$
- 9) Bond angle of  $OF_2$  is : (DGK-2011)
- $180^\circ$
  - $120^\circ$
  - $107^\circ$
  - $105^\circ$
- 10)  $Cl_2O_7$  reacts with water to form: (DGK-2012)
- $HClO$
  - Chloric acid
  - Per chloric acid
  - $Cl_2$  and  $O_2$
- 11) Which one is chlorous acid? (DGK-2015-II)
- $HClO$
  - $HClO_2$
  - $HClO_3$
  - $HClO_4$
- 12) Which is the strongest acid? (SAH-2017-II), (SGD-2019)
- $HClO$
  - $HClO_2$
  - $HClO_3$
  - $HClO_4$

### III) From Entry Test:

- Which of the following non-metals do combine with  $Cl_2$ ,  $Br_2$ ,  $I_2$ ?  
 (a) Carbon (b) Nitrogen  
 (c) Oxygen (d) All of these
- Heat of hydration is maximum for:  
 (a)  $F^-$  (b)  $Cl^-$   
 (c)  $Br^-$  (d)  $I^-$
- Which of the following halogen oxide is in nature?  
 (a)  $I_4O_9$  (b)  $I_2O_5$   
 (c)  $BrO_2$  (d)  $ClO_3$
- Which of the following has maximum vapour pressure?  
 (a) HF (b) HCl  
 (c) HBr (d) HI
- Anhydride of  $HIO_3$  is:  
 (a)  $I_2O_3$  (b)  $I_2O_5$   
 (c)  $I_2O_7$  (d)  $IO_2$
- Chemical composition of hypo is:  
 (a)  $Na_2SO_3$  (b)  $Na_2S_2O_3$   
 (c)  $Na_2S_2O_3 \cdot 5H_2O$  (d)  $Na_2S_2O_3 \cdot 3H_2O$
- Which of the following halogen is in solid form at room temperature?  
 (a)  $I_2$  (b)  $F_2$   
 (c)  $Br_2$  (d)  $Cl_2$
- Which of the halogens is most easily reduced?  
 (a)  $I_2$  (b)  $Br_2$   
 (c)  $F_2$  (d)  $Cl_2$
- What is the reason for lowest bond dissociation energy of  $F_2$  among the halogens:  
 (a) Low I.E  
 (b) Absence of d orbitals  
 (c) Low lattice energy of salts  
 (d) Repulsion among non-bonding electrons
- Which silver salt is sparingly soluble in  $H_2O$ :  
 (a) AgF (b) AgBr  
 (c) AgCl (d) AgI
- All the halogens are coloured. The intensity of the colour depends on:  
 (a) Valence electron (b) Atomic number  
 (c) Atomic mass (d) None of these



- (12) Oxidation state of Ca in  $\text{Ca}(\text{OCl})\text{Cl}$  (bleaching powder) is:  
 (a) +3 (b) +4  
 (c) +2 (d) +1
- (13) Which of the following has greater volatility?  
 (a)  $\text{CH}_3\text{F}$  (b)  $\text{CH}_3\text{Cl}$   
 (c)  $\text{CH}_3\text{Br}$  (d)  $\text{CH}_3\text{I}$

## SECTION II

## SHORT QUESTIONS

## From Exercises:

## QUESTIONS

- How the halogen acids are ionized in water?
- Why HF is weaker acid than HCl?
- In the following sets, arrange the substances in order of the property indicated. Give reasons!
  - Increasing acidic character  
 $\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$ ,  $\text{HClO}_4$
  - Increasing oxidizing power  
 $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{I}_2$
- What happens when bleaching powder reacts with the following reagents dil.  $\text{H}_2\text{SO}_4$ , excess of conc.  $\text{H}_2\text{SO}_4$ ,  $\text{NH}_3$ ,  $\text{HI}$  and  $\text{CO}_2$ .
- Why iodine has metallic luster?
- Which halogen sublimates to violet vapours?

## ANSWERS

- Halogen acids ionize in water and form halide ions and hydronium ions. e.g.,
 
$$\text{HF} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+ + \text{F}^-$$

$$\text{HCl} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$$

$$\text{HBr} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+ + \text{Br}^-$$

$$\text{HI} + \text{H}_2\text{O} \longrightarrow \text{H}_3\text{O}^+ + \text{I}^-$$
- In case of halogen acids:  
 Acidic strength  $\propto$  Ionization  
 HF due to strong hydrogen bonding has less ionization and HCl ionizes more than HF so, HF is weaker acid than HCl.
- (a) The order of increasing acidic character of given acids is as following:  
 $\text{HClO}_4 > \text{HClO}_3 > \text{HClO}_2 > \text{HClO}$   
**Reason:** In case of oxyacids of halogens the acidic strength increases with the increase in the number of oxygen atoms or oxidation state. As

the oxidation state of the halogen increases, the bonding electrons are shifted away from the H-atom and tendency of the molecule to lose a proton increases which ultimately increase the acidic character.

- (b) The order of increasing oxidizing power of halogens is given as:

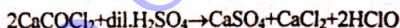


**Reason:** Oxidizing power of halogens depends upon:

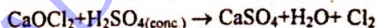
- Energy of dissociation.
- Electron affinity of atoms.
- Hydration energy of ion.
- Heat of vaporization.

If a halogen atom has low dissociation energy, high electron affinity and high hydration energy of its ions, it will have high oxidizing power.

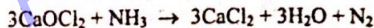
4. With dil.  $\text{H}_2\text{SO}_4$ :



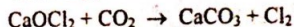
With conc.  $\text{H}_2\text{SO}_4$ :



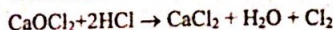
With  $\text{NH}_3$ :



With  $\text{CO}_2$ :



With HCl:

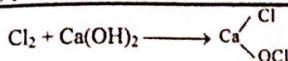


- Metallic luster is due to excitation of electrons. When excited electrons come back they emit radiations. Due to bigger size, electrons of iodine excite at room temperature and it appears as lustrous greyish black solid.
- Among halogens iodine sublimates to violet vapours.

## II) From Punjab Boards:-

- What are disproportionation reactions? Explain with an example. (LHR 2013, ADK 2011)
- What is bleaching power? (SAH-2014)
- Why iodine has metallic luster? (LHR 2014, 2015, 2017, 2019), (GRW 2010, 2018), (BWP 2017), (FSD 2014, 2018), (DGK 2016, 2017)
- How halogen acids are ionized in water? (LHR-2011), (SAH-2018)



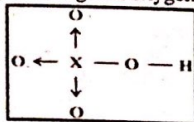


11. Following factors are responsible for the oxidizing powers of halogens:

- Heat of dissociation.
- Electron affinities of the atoms.
- Hydration energy of the ions.
- Heat of vaporization.

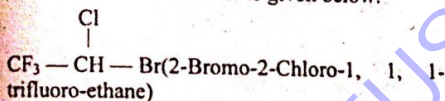
All free halogens act as oxidizing agents when they react with metals or non-metals.

12. An oxyacid molecule contains hydrogen linked to the halogen through an oxygen atom.



The acidic strength of oxyacids depends upon the polarity of O-H bond, which depends on the electro negativity of central halogen atom. Chlorine is more electronegative element therefore oxyacids of chlorine ( $\text{HClO}_4$ ) are stronger than the corresponding oxyacids of bromine and iodine.

13. The structure of halothane is given below:



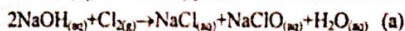
And halothane is used as an anaesthetic. It is the only inhalational anaesthetic containing bromine. It is colourless but pleasant smelling.

14. (i) HF is a colourless volatile liquid.  
 (ii) HF have strong hydrogen bonding.  
 (iii) It is more viscous  
 (iv) HF attack glass and has found application as non-aqueous solvent.
15. The amount of chlorine set free is called "available chlorine". The amount of bleaching powder is measured in terms of available chlorine. The average percentage of available chlorine in bleaching powder is 35-40 percent. The bleaching action of bleaching powder is due to its oxidative character.

16. **Disproportionation reactions:**

"A reaction, in which a species (molecule, atom or ion) is simultaneously oxidized and reduced, is called a disproportionation reaction".

In cold ( $15^\circ\text{C}$ ) state chlorine will react with  $\text{NaOH}_{(\text{aq})}$  to form hypochlorite and a halide.



The reaction is a disproportionation reaction, because the zero oxidation state of chlorine atom in  $\text{Cl}_2$  is converted to -1 in chloride and +1 in hypochlorite.

## SECTION III

### LONG QUESTIONS

1. Give rules for nomenclature of oxy-acids of halogens. (LHR-2015-I), (DGK-15)
2. What happens when bleaching powder reacts with: (GRW-2015)
  - i. dil.  $\text{H}_2\text{SO}_4$
  - ii. cons.  $\text{H}_2\text{SO}_4$
  - iii.  $\text{NH}_3$
  - iv.  $\text{HI}$
3. Discuss relative reactivities of halogens as oxidizing agent. (MTN-2015)
4. Describe preparation of bleaching powder by Beckmann's method. Also give chemical equations. (MTN-2016-II)
5. How does bleaching powder reacts with  $\text{NH}_3$ ,  $\text{HCl}$ ,  $\text{H}_2\text{O}$ , dil  $\text{H}_2\text{SO}_4$ ? (FSD-2013)
6. What are the commercial uses of halogens and their compounds? (RWP-2015)
7. How bleaching powder is prepared by Hasenclever's method? Give its reactions with  $\text{HCl}$  and  $\text{NH}_3$ . (SGD-2016)
8. How bleaching powder is prepared? Give its uses. (SAH-2015), (MTN-16)



## Chapter — 6

### TRANSITION ELEMENTS

#### SECTION I

#### Multiple Choice Questions

##### I. From Exercise-

1. Which of the following is a non-typical transition element?
  - (a) Cr
  - (b) Mn
  - (c) Zn
  - (d) Fe



2. Which of the following is a typical transition metal ?  
 (a) Sc (b) Y  
 (c) Ra (d) Co
3. f-Block elements are also called?  
 (a) non-typical transition elements  
 (b) Outer transition elements  
 (c) normal transition elements  
 (d) None is true
4. The strength of binding energy of transition elements depends upon  
 (a) number of electron pairs  
 (b) number of unpaired electrons  
 (c) number of neutrons  
 (d) number of protons
8. The colour of transition metal complexes is due to  
 (a) d-d transition of electrons  
 (b) paramagnetic nature of transition elements  
 (c) ionization.  
 (d) loss of s-electrons.

### II) From Punjab Boards:-

- 1) Following property of transition elements does not vary with a regular pattern:  
 (LHR-2011)  
 (a) Binding energy (b) Melting point  
 (c) Covalent radius (d) Cationic radius
- 2) Which specie has maximum number of unpaired electrons?  
 (GRW-2015)  
 (a)  $O_2$  (b)  $O_2^{1+}$   
 (c)  $O_2^{1-}$  (d)  $O_2^{2-}$
- 3) Which of the following has greatest number of unpaired electrons?  
 (BWP-2014)  
 (a) Fe (b)  $FeO$   
 (c)  $MnO$  (d)  $CrO$
- 4) Which of the following is a non-typical transition element? (SGD-2016-II, 2017), (FSD-14), (LHR-15), (GRW-10, 17), (MTN-16), (RWP-18), (DGK-18), (LHR-18)  
 (a) Zn (b) Cr  
 (c) Mn (d) Co
- 5) The strength of binding energy of transition elements depends upon: (SAH-2013), (GRW-13), (MTN-18)  
 (a) Number of electron pairs  
 (b) Number of unpaired electrons  
 (c) Number of neutrons  
 (d) Number of protons

- 6) The colour of transition metal is due to:  
 (AJK-2016), (GRW-12), (LHR-14)  
 (a) d-d transition of electrons  
 (b) paramagnetic nature of transition metals  
 (c) Ionization  
 (d) loss of s-electrons

### III) From Entry Test:-

- (1) The element with highest melting point:  
 (a) Mn (b) Fe  
 (c) Cr (d) Cu
- (2) The least paramagnetism is shown by:  
 (a)  $V^{3+}$  (b)  $Cu^{2+}$   
 (c)  $Cr^{3+}$  (d)  $Mn^{2+}$
- (3) White vitriol is:  
 (a) ZnS (b)  $ZnSO_4$   
 (c)  $ZnSO_4 \cdot 7H_2O$  (d)  $ZnCO_3$
- (4) The colour of transition metal complexes is due to:  
 (a) d-d transition of electrons  
 (b) Paramagnetic nature of transition elements  
 (c) Ionization  
 (d) Loss of s-electrons
- (5) The strongest paramagnetism is shown by:  
 (a)  $Mn^{2+}$  (b)  $Cu^{2+}$   
 (c)  $Cr^{3+}$  (d)  $V^{3+}$
- (6) Ferromanganese contains:  
 (a) Fe, Mg, C (b) Fe, Cr, C  
 (c) Fe, Mn, C (d) Fe, Si, C
- (7) Which of the following cation has maximum unpaired electrons?  
 (a)  $Ni^{+2}$  (b)  $Co^{+2}$   
 (c)  $Mn^{+2}$  (d)  $Fe^{2+}$
- (8) The black image on an exposed and developed photographic film is composed of:  
 (a) Ag (b)  $Ag_2O$   
 (c)  $AgBr$  (d)  $Ag[(CrO_3)_2]^-$

## SECTION II

### SHORT QUESTIONS

#### From Exercise:-

### QUESTIONS

2. Explain the following giving reasons:  
 (a) Why does damaged tin plated iron get rusted quickly.  
 (b) Under what conditions does aluminium corrode?



is damaged then the iron  
moisture and get rusted  
of Galvanic cell. In this  
ated iron gets rusted more  
that water promotes the  
our is due to the presence  
n an atom, molecule, ion  
netic moment associated  
electron. When the electrons  
all, the magnetic moments  
the substance becomes

tween atoms of transition  
attice are called interstices  
, C, N enter into these and  
to them and are called

cal decay of metals due to  
inding medium is called

sheets are corrosion free,  
metal is brought in contact  
et corroded.

s in contact with less active  
h values of reduction  
per a galvanic cell is  
ell the Al metal act as a  
Al<sup>3+</sup> ions, which attracts  
(OH)<sub>3</sub> and starts dissolving.  
on the Cu receive the  
ed as H<sub>2</sub>. In this way  
apidly.



### ON III

### QUESTIONS

onfiguration of valence shell  
properties of the transition  
(LHR-2013-I), (DGK-14)  
Oxidation state

- theory of corrosion (SAH-18)
- What is galvanizing or anode coating? (DGK-13)  
(RWP-2014)
  - What is the difference between paramagnetic and diamagnetic substances? (SGD-2013)
  - Mn<sup>2+</sup> and Fe<sup>2+</sup> have the strongest paramagnetic behaviour while Sc<sup>3+</sup> and Zn<sup>2+</sup> have the lowest. Discuss. (DGK-2011)



## Chapter — 7

# FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY

## SECTION I

### Multiple Choice Questions

#### 1) From Exercise:-

- The state of hybridization of carbon atom in methane is:  
(a) sp<sup>3</sup> (b) sp<sup>2</sup>  
(c) sp (d) dsp<sup>2</sup>
- In t-butyl alcohol, the tertiary carbon is bonded to:  
(a) two hydrogen atoms  
(b) three hydrogen atoms  
(c) one hydrogen atom  
(d) no hydrogen atom
- Which set of hybrid orbitals has planar triangular shape?  
(a) sp<sup>3</sup> (b) sp  
(c) sp<sup>2</sup> (d) dsp<sup>2</sup>
- The chemist who synthesized urea from ammonium cyanate was:  
(a) Berzelius (b) Kolbe  
(c) Wohler (d) Lavoisier



5. Linear shape is associated with which set of hybrid orbitals?

- (a)  $sp$  (b)  $sp^2$   
(c)  $sp^3$  (d)  $dsp^2$

6. A double bond consists of:

- (a) two sigma bonds  
(b) one sigma and one pi bond  
(c) one sigma and two pi bonds  
(d) two pi bonds

7. Ethers show the phenomenon of:

- (a) position isomerism  
(b) functional group isomerism  
(c) metamerism  
(d) cis-trans isomerism

8. Select from the following the one which is alcohol:

- (a)  $CH_3-CH_2-OH$  (b)  $C_6H_5-O-CH_3$   
(c)  $CH_3COOH$  (d)  $CH_3-CH_2-Br$

### (II) From Punjab Boards:-

1) Carbon atom in following is  $sp^2$ -hybridized:

(LHR-2011)

- (a)  $CH_3CN$  (b)  $CH \equiv CH$   
(c)  $HCOOH$  (d)  $CH_2Cl_2$

2) Pentane ( $C_5H_{12}$ ) shows how many chain isomers?

(LHR-2012-I), (GRW-11)

- (a) 2 (b) 3  
(c) 4 (d) 5

3) The process used to improve quality of gasoline is called:

(LHR-2014-I)

- (a) Thermal cracking (b) Reforming  
(c) Steam cracking (d) Combustion

4) Select from the following the one which is alcohol:

(LHR-2015-I)

- (a)  $CH_3CH_2OH$  (b)  $CH_3OCH_3$   
(c)  $CH_3COOH$  (d)  $CH_3CH_2Br$

5) Select the following one which is alcohol?

(LHR-2015-II)

- (a)  $CH_3OCH_3$  (b)  $CH_3CH_3$   
(c)  $CH_3CH_2OH$  (d)  $CH_3-Cl$

6) Geometric isomerism is present in:

(GRW-2010)

- (a) Methane (b) Ethane  
(c) Propane (d) 2-butene

7) The state of hybridization of carbon atom in methane is:

(GRW-2013, 18),

(LHR-10, 13), (MTN-16), (FSD-18)

- (a)  $sp^3$  (b)  $sp^2$   
(c)  $sp$  (d)  $dsp^2$

8) A double bond consists of: (BWP-14, 18),

(FSD-13, 15), (GRW-16),

(RWP-16), (SAH-18)

(a) two sigma bonds

(b) one sigma and one pi-bond

(c) one sigma and two pi bonds

(d) two pi bonds

9) The bond angle between any two  $sp^2$ -hybridized orbitals is of: (BWP-2015)

(a)  $180^\circ$  (b)  $109.5^\circ$

(c)  $120^\circ$  (d)  $107.5^\circ$

10) Formula of Chloroform is: (BWP-2016)

(a)  $CH_3-OH$

(b)  $CH_3-Cl$

(c)  $CH_2Cl_2$

(d)  $CHCl_3$

11) Which one is the heterocyclic compound of oxygen? (RWP-2015)

(a) Pyridine

(b) Pyrrole

(c) Furan

(d) Thiophene

12) In t-butyl alcohol, the tertiary carbon is bonded to: (RWP-2017), (GRW-14),

(MTN-15), (LHR-16), (FSD-17), (SAH-17)

(a) Three hydrogen atoms

(b) Two hydrogen atoms

(c) One hydrogen atom

(d) No hydrogen atom

13) Ethers show the phenomenon of:

(SGD-2014, 18), (MTN-17, 18),

(LHR-17), (RWP-18)

(a) Position isomerism

(b) Functional group isomerism

(c) Metamerism

(d) Chain isomerism

14) Which set represent the planar triangular shape? (DGK-2016)

(a)  $sp^3$

(b)  $sp^2$

(c)  $sp$

(d)  $dsp^2$

15) Linear shape is associated with which set of hybrid orbital? (SAH-2017),

(DGK-13, 14, 15, 17, 18), (MTN-13, 14),

(BWP-14, 17), (GRW-15), (SGD-18)

(a)  $sp$

(b)  $sp^2$

(c)  $sp^3$

(d)  $dsp^2$

16) The chemist who synthesized urea from ammonium cyanate was: (AJK-2016),

(FSD-14), (LHR-14)

(a) Berzelius

(b) Kolbe

(c) Wohler

(d) Lavoisier

**(II) From Entry Test:**

- (1) Number of tertiary carbon atoms in methyl cyclopropane is:
  - (a) Zero (b) 1
  - (c) 2 (d) 3
- (2) The number of  $\pi$ -bonds present in acrylonitrile is:
  - (a) 1 (b) 2
  - (c) 3 (d) 4
- (3) Homolytic fission of covalent bond results in the formation of:
  - (a) Free radicals (b) Carbanions
  - (c) Carbocations (d) Both (a) and (b)
- (4) Free radicals are characterised by:
  - (a) Paramagnetism (b) Diamagnetism
  - (c) Loss of electrons (d) Low reactivity
- (5) The various compounds corresponding to molecular formula  $C_4H_{10}$  are:
  - (a) Chain isomers
  - (b) Positional isomers
  - (c) Functional group isomers
  - (d) Tautomers
- (6) Glucose and fructose are isomers:
  - (a) Chain isomers
  - (b) Position isomers
  - (c) Functional group isomers
  - (d) Metamers
- (7) Which of the following is not heterocyclic?
  - (a) Pyridine (b) Furan
  - (c) Thiophene (d) Aniline
- (8) Hybrid orbitals form:
  - (a) Sigma bonds (b) Pi-bonds
  - (c) Both (d) None
- (9) Which of the compounds cannot show positional isomerism?
  - (a) Alkanes (b) Alkenes
  - (c) Alkynes (d) Alcohols
- (10) Which type of hybridization is present in  $CH_3^+$ ?
  - (a)  $sp^3$  (b)  $sp^2$
  - (c)  $sp$  (d)  $dsp^3$
- (11) How many sigma electrons are present in ethylene?
  - (a) 2 (b) 5
  - (c) 8 (d) 10

- (12) The shape of molecule is decided by:
  - (a) Number of hybrid orbitals
  - (b) Number of unhybrid orbitals
  - (c) Number of hybrid and unhybrid orbitals
  - (d) Number core electrons in the central atom of the molecule
- (13) In ethene molecule, the number of atoms which are in the same plane:
  - (a) 2 (b) 4
  - (c) 6 (d) 3
- (14) The reaction  $C_3H_8 \xrightarrow{\Delta} C_3H_6 + \text{Fragments}$  is:
  - (a) Catalytic oxidation
  - (b) Isomerization
  - (c) Synthesis (d) Cracking
- (15) The octane number is 100% in petroleum:
  - (a) Neo-octane (b) n-Hexane
  - (c) Neo-pentane (d) Iso-octane
- (16) Concept of octane number was introduced by:
  - (a) Kekule (b) Edgar
  - (c) Wohler (d) Dalton

**SECTION II****SHORT QUESTIONS****From Exercise-****QUESTIONS**

1. Write the structural formulas of the two possible isomers of  $C_4H_{10}$ .
2. Why is ethene an important industrial chemical?
3. What is meant by a functional group? Name typical functional groups containing oxygen.
4. Explain the type of bonds and shapes of the following molecules using hybridization approach:  $CH_3 - CH_3$ ,  $CH_2 = CH_2$ ,  $CH \equiv CH$ ,  $HCHO$ ,  $CH_3Cl$
5. Why there is no free rotation around a double bond and a free rotation around a single bond?

**ANSWERS**

1. Two possible isomers of  $C_4H_{10}$  are:
  - (i)  $H_3C - CH_2 - CH_2 - CH_3$   
(n-butane)
  - (iii)  $H_3C - CH - CH_3$   
|  
 $CH_3$   
(iso-butane)



12. Define isomerism. Explain geometrical isomerism with examples. (FSD-2017), (LHR-13), (RWP-14), (GRW-16)
13. Define atomic orbital hybridization. Explain the structure of ethylene on the basis of hybridization. (RWP-2015), (FSD-14), (LHR-14, 15)
14. Define a functional group. Write functional groups of ethers, esters, carboxylic acids. (SGD-2013), (GRW-12, 13)
15. Define four types of isomerism with one example each. (SGD-2014), (LHR-15)
16. Explain  $sp^2$ -hybridization and explain the structure of ethene on the basis of their type of hybridization. (DGK-2011, 2015), (LHR-12), (FSD-13), (SGD-16, 17), (BWP-17), (MTN-17)
17. Describe structures of  $C_2H_4$  and  $C_2H_2$  by process of hybridization. (SAH-2017)



## Chapter — 8

### ALIPHATIC HYDROCARBONS

#### SECTION I

#### Multiple Choice Questions

##### I) From Exercise:-

1. Preparation of vegetable ghee involves:
  - (a) Halogenation
  - (b) Hydrogenation
  - (c) Hydroxylation
  - (d) Dehydrogenation
2. Formula of chloroform is:
  - (a)  $CH_3Cl$
  - (b)  $CCl_4$
  - (c)  $CH_2Cl_2$
  - (d)  $CHCl_3$
3. The presence of a double bond in a compound is the sign of format correction:
  - (a) Saturation
  - (b) Unsaturation
  - (c) Substitution
  - (d) None
4. Vinyl acetylene combines with HCl to form:
  - (a) Polyacetylene
  - (b) Benzene
  - (c) Chloroprene
  - (d) Divinyl acetylene

5. The addition of unsymmetrical reagent to unsymmetrical alkene is in accordance with the rule.

- (a) Hund's rule
- (b) Markownikov's rule
- (c) Pauli's Exclusion principle
- (d) Aufbau principle

6. Synthetic rubber is made by polymerization of:

- (a) Chloroform
- (b) Acetylene
- (c) Divinylacetylene
- (d) Chloroprene

7.  $\beta, \beta'$  - dichloroethyl sulphide is commonly known as:

- (a) Mustard gas
- (b) Laughing gas
- (c) Phosgene gas
- (d) Bio-gas

8. When methane reacts with  $Cl_2$  in the presence of diffused sun light products obtained are:

- (a) Chloroform only
- (b) Carbon tetrachloride only
- (c) Chloromethane and dichloromethane
- (d) Mixture of a,b,c

9. Which one of the following gases is used for artificial ripening of fruits?

- (a) Ethene
- (b) Ethyne
- (c) Methane
- (d) Propane

##### II) From Punjab Boards:-

- 1) Sabatier-Sendern's reaction can be used to prepare: (LHR-2012-13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100)
  - a) Alkynes
  - b) Alkenes
  - c) Alkanes
  - d) All
- 2) The isomerism shown by alkanes is: (LHR-2012-13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100)
  - a) Skeletal
  - b) Position
  - c) Geometric
  - d) Metamerism
- 3)  $\beta, \beta'$ -Dichloroethyl sulphide is commonly known as: (LHR-2012-II, 13, 15), (GRW-2012-13, 14, 15), (SGD-15, 18), (SAH-2012-13, 14, 15)
  - a) Laughing gas
  - b) Phosgene gas
  - c) Mustard gas
  - d) Bio gas
- 4) The catalytic oxidation of methane produces: (LHR-2012-13, 14, 15), (GRW-2012-13, 14, 15), (SGD-15, 18), (SAH-2012-13, 14, 15)
  - a)  $CO + H_2O$
  - b)  $CO_2 + H_2O$
  - c)  $C + H_2O$
  - d)  $H_3C - OH$

- 5) Which one of the following gases is used for artificial ripening of fruits?  
(LHR-2015-I), (GRW-15), (FSD-13), (BWP-17)  
a) Methane                      b) Ethene  
c) Ethane                        d) Propane
- 6) Synthetic rubber is made by polymerization of:  
(LHR-2016-I)  
a) Chloroprene                b) Chloroform  
c) Acetylene                   d) Divinyl acetylene
- 7) Preparation of vegetable ghee involves:  
(LHR-2017), (MTN-14), (RWP-15)  
(a) Halogenation            (b) Hydrogenation  
(c) Hydroxylation          (d) Dehydrogenation
- 8)  $\beta, \beta$ -dichloroethyl sulphide is prepared by treating sulphur monochloride with:  
(GRW-2010)  
a) Ethane                        b) Ethene  
c) Ethyne                        d) Methane
- 9) Lindlar's catalyst is: (GRW-2011)  
a)  $\text{Ba}[\text{PbSO}_4]$  Quinoline  
b)  $\text{Pd}[\text{PbSO}_4]$  Quinone  
c)  $\text{Pd}[\text{BaSO}_4]$  Quinoline  
d)  $\text{Pd}[\text{BeSO}_4]$  Quinone
- 10) Chloroprene is used for making:  
(GRW-2012)  
a) Rubber                        b) Petrol  
c) Propane                       d) Liquid fuel
- 11) Vinyl acetylene combines with HCl to form:  
(MTN-2017, 18)  
(a) Polyacetylene            (b) Benzene  
(c) Chloroprene                (d) Divinyl acetylene
- 12) The addition of unsymmetrical reagent to an unsymmetrical alkene is in accordance with the rule:  
(BWP-2014)  
a) Hund's rule  
b) Markownikov's rule  
c) Pauli's exclusion principle  
d) Aufbau principle
- 13)  $\text{CH}_4 + \text{Cl}_2 \xrightarrow[\text{sunlight}]{\text{Diffused}}$  product is: (FSD-2017)  
a) Chloroform only          b)  $\text{CCl}_4$  only  
c)  $\text{CH}_3\text{Cl} + \text{CH}_2\text{Cl}_2$       d) Mixture of a, b, c
- 14) Formula of Marsh gas is: (RWP-2016)  
a)  $\text{CH}_4$                             b)  $\text{C}_2\text{H}_6$   
c)  $\text{C}_3\text{H}_8$                           d)  $\text{C}_4\text{H}_{10}$
- 15) The addition of unsymmetrical reagent to an unsymmetrical alkene is in accordance with rule. (SGD-2016-II)  
a) Aufbau Principle  
b) Markownikov's rule  
c) Hund's rule  
d) Pauli's Exclusion Principle
- 16) Formula of chloroform is: (DGK-11-13, 17, 18), (SGD-13), (FSD-14, 15), (MTN-14), (GRW-17), (BWP-15, 18)  
a)  $\text{CH}_3\text{Cl}$                         b)  $\text{CH}_2\text{Cl}_2$   
c)  $\text{CHCl}_3$                         d)  $\text{CCl}_4$
- 17) Hydrogenolysis of an alkyl halide takes place in the presence of catalyst:  
(DGK-2012)  
a)  $\text{N}_2\text{H}_4/\text{KOH}$                 b)  $\text{Zn-Hg}/\text{HCl}$   
c)  $\text{Pd}/\text{C}$                             d)  $\text{Ni-Al}$
- 18) Synthetic rubber is made by polymerization of:  
(DGK-2015, 18), (GRW-14, 18), (LHR-13, 14), (BWP-14), (SGD-17), (MTN-17), (FSD-18), (RWP-18)  
a) Chloroform                b) Acetylene  
c) Divinyl acetylene        d) Chloroprene
- 19) Which one is not a property or use of mustard gas: (DGK-2015-II)  
a) Used in 1<sup>st</sup> world war  
b) Powerful vesicant  
c) High boiling liquid  
d) High boiling gas
- 20) Synthetic rubber is made by polymerization of:  
(DGK-2016)  
a) Chloroform                b) Methane  
c) Ethyne                        d) Ethene
- 21) The presence of a double bond in a compound is the sign of: (AJK-2016), (DGK-14), (RWP-17), (SAH-17)  
a) Saturation                b) Unsaturation  
c) Substitution              d) Elimination
- IIb From Entry Test:-**
- (1) Formation of alkane by the action of zinc and alkyl halide is called:  
(a) Cannizzaro's reaction  
(b) Frankland's reaction  
(c) Wurtz's reaction  
(d) Kolbe's reaction



- (2) Clemmenson's reduction involves  $\text{>C=O}$   
 $\longrightarrow \text{>CH}_2$  in the presence of:  
 (a) Zn / Hg (b) Alcohol  
 (c) Zn dust (d) Zn factor
- (3) Which reacts readily with  $\text{Br}_2$ ?  
 (a)  $\text{C}_2\text{H}_6$  (b)  $\text{C}_3\text{H}_8$   
 (c)  $\text{C}_4\text{H}_8$  (d)  $\text{C}_4\text{H}_{10}$
- (4) It is dangerous to work with liquid  $\text{C}_2\text{H}_2$  because:  
 (a) It readily catches fire  
 (b) It is highly volatile  
 (c) It is explosive  
 (d) It is not very reactive
- (5) 2-methyl 1, 3-Butadiene is called:  
 (a) Styrene (b) Cumene  
 (c) Chloroprene (d) Isoprene
- (6) Acetylene reacts with acetic acid in the presence of  $\text{HgO}$  to form vinyl acetate which is used in chewing gums and plastics. The process is called:  
 (a) Esterification (b) Polymerization  
 (c) Hydrogenation (d) Vinylation
- (7) Ethyl bromide reacts with Zn and HCl to form:  
 (a) Ethane (b) Ethene  
 (c) Ethyne (d) Propyne
- (8) Which of the following does not change when ethene is polymerized to form polyethylene?  
 (a) Melting point (b) Density  
 (c) Molar mass (d) % composition
- (9) Ethene is produced from ethyl chloride by reacting with alcoholic KOH. The process is called:  
 (a) Hydrogenation  
 (b) Dehydrogenation  
 (c) Dehydrohalogenation  
 (d) Oxidation
- (10) Carbocation is formed as a result of:  
 (a) Homolytic fission  
 (b) Heterolytic fission  
 (c) Both (d) None

- (11) Substitution reaction in acetylene is possible by:  
 (a) Na metal (b)  $\text{NaNH}_2$   
 (c) Ammonical  $\text{AgNO}_3$  (d) All
- (12) Conversion of sodium acetate to methane in the presence of soda lime is called:  
 (a) Carboxylation (b) Decarboxylation  
 (c) Dehydrohalogenation  
 (d) Hydrogenation
- (13) Which of the following is the major product when HBr reacts with 2-butene?  
 (a) 2-bromobutane  
 (b) 1-bromobutane  
 (c) 1, 1 dibromobutane  
 (d) 1, 2 dibromobutane
- (14) Acetylene reacts with  $\text{N}_2$  to form:  
 (a) HCl (b)  $\text{CH}_3 - \text{CN}$   
 (c) HCN (d)  $\text{CH}_3\text{NH}_2$
- (15) Preparation of vegetable ghee involves:  
 (a) Halogenation (b) Hydrogenation  
 (c) Hydroxylation (d) Dehydrogenation
- (16) Which type of reactions are given by alkanes?  
 (a) Polymerization (b) Elimination  
 (c) Addition (d) Substitution
- (17) The most reactive hydrocarbon is:  
 (a) Ethene (b) Acetylene  
 (c) Heptane (d) Ethane
- (18) Formula of chloroform is:  
 (a)  $\text{CH}_3\text{Cl}$  (b)  $\text{CCl}_4$   
 (c)  $\text{CH}_2\text{Cl}_2$  (d)  $\text{CHCl}_3$
- (19) Cycloalkanes and mono alkenes have general formula:  
 (a)  $\text{C}_n\text{H}_{2n+2}$  (b)  $\text{C}_n\text{H}_{2n}$   
 (c)  $\text{C}_n\text{H}_{2n-2}$  (d)  $\text{C}_n\text{H}_n$

## SECTION II

### SHORT QUESTIONS

From Exercise:-

### QUESTIONS

1. Write the structural formula for each of the following compounds:  
 (i) 2-methylpropane (ii) Neopentane  
 (iii) 3-ethylpentane



Write reactions of ethene with  $\text{HBr}$ ,  $\text{Br}_2$ ,  $\text{O}_3$ ,  $\text{HOCl}$ . (MTN-2013)  
 Convert ethyne into acetaldehyde and oxalic acid. (MTN-2014)  
 Convert acetylene into glyoxal and chloroprene. (MTN-2015)

Explain with equations how alkanes can be prepared from (i) Acids (ii) Grignard's Reagent. (MTN-2016)

How will you bring about the following conversions. (MTN-2016)

(i) 1-Butene to 1-Butyne  
 (ii) 1-Propanol to  $\text{CH}_3 \cdot \text{CH}(\text{OH}) \cdot \text{CH}_2\text{Cl}$   
 How will you make the following conversions? (MTN-2017)

(i) n-propyl bromide into propane  
 (ii) Propanoic acid into Ethane  
 (iii) Ethane into Methane  
 (iv) 2-Butyne into Cis-2-Butene

What do you mean by saturated and unsaturated hydrocarbons? How these are distinguished chemically? (BWP-2014)

Write the reaction of ethyne with following: (BWP-2015)

(i)  $\text{H}_2$  (ii)  $\text{Cl}_2$  (iii)  $\text{HBr}$  (iv)  $\text{NH}_3$   
 How alkene and alkynes can be prepared from vicinal dihalides? (FSD-2014)

How the presence of double bond is detected by using Baeyer's reagent. (FSD-2014)

How will you convert ethane into ethyl alcohol, ethylene epoxide, ethylene glycol and ethylene chlorohydrin. (FSD-2015)

Write the reactions of ethane with: (FSD-2017)

(i)  $\text{HOCl}$  (ii) dilute  $\text{KMnO}_4$   
 (iii) Ozone (iv)  $\text{S}_2\text{Cl}_2$

How by two reactions that ethene and ethyne are unsaturated. How can they be distinguished from each other? (RWP-2014)

How will you synthesize the following compounds starting from ethyne. (RWP-2015)

Acetaldehyde (ii) Methyl nitrile  
 (i) Ethane (iv) Acrylonitrile  
 Explain the acidic behaviour of Ethyne. (RWP-2016)

Make the following changes: (RWP-2017)

Ethyne into chloroprene  
 Ethyne into Benzene

38. Describe Clemmensen and Wolff-Kishner reduction for preparation of alkanes. (SGD-2013)
39. Give two methods of preparation of alkenes (ethene) and also two tests to establish double bond in alkene. (SGD-2014)
40. Discuss acidic nature of alkynes. (SGD-2016)
41. Write a note on halogenation of alkanes. (SGD-2017)
42. Explain free radical mechanism for reaction of chlorine with methane in the presence of sunlight. (DGK-2011)
43. Discuss in detail the rules for naming alkanes by IUPAC system. (DGK-2012)
44. Starting from Ethyne, how would you prepare glyoxal and benzene? (DGK-2013)
45. Write a note on acidic character of alkynes. Write chemical equations. (DGK-2015)
46. How will you synthesize the following compounds starting from ethyne? (DGK-2016)
  - (i) Chloroprene (ii) Glyoxal
  - (iii) Methyl nitrile (iv) Acetaldehyde
47. How acetylene can be converted into: (DGK-2017)
  - (i) Acetaldehyde (ii) Chloroprene
  - (iii) Acrylonitrile (iv) Divinyl acetylene
48. State Markownikov's rule. Give reactions of  $\text{HBr}$  with (i) Propene (ii) 2-Butene (iii) 1-Butene. (SAH-2014)
49. Write a note on acidic character of alkynes. (SAH-2015)
50. Describe mechanism for the electrolysis of potassium maleate to prepare ethyne. (SAH-2017)



## Chapter — 9

### AROMATIC HYDROCARBONS

#### SECTION I

#### Multiple Choice Questions

##### 1) From Exercise:-

1. The benzene molecule contains:

- (a) Three double bonds
- (b) Two double bonds
- (c) One double bond
- (d) Delocalized  $\pi$ -electron charge



## 2. Aromatic hydrocarbons are the derivatives of:

- (a) Normal series of paraffins  
(b) alkene  
(c) benzene  
(d) cyclohexane

## 3. Which of the following acid can be used as a catalyst in Friedel-Crafts reactions?

- (a)  $\text{AlCl}_3$  (b)  $\text{HNO}_3$   
(c)  $\text{BeCl}_2$  (d)  $\text{NaCl}$

## 4. Benzene cannot undergo:

- (a) Substitution reactions  
(b) addition reactions  
(c) oxidation reactions  
(d) elimination reactions

## 5. Amongst the following the compound that can be most readily sulphonated is:

- (a) toluene (b) benzene  
(c) nitrobenzene (d) chlorobenzene

## 6. During nitration of benzene the active nitrating agent is:

- (a)  $\text{NO}_3$  (b)  $\text{NO}_2^+$   
(c)  $\text{NO}_2^-$  (d)  $\text{HNO}_3$

## 7. Which compound is the most reactive one?

- (a) Benzene (b) ethene  
(c) ethane (d) ethyne

## 8. The electrophile in aromatic sulphonation:

- (a)  $\text{H}_2\text{SO}_4$  (b)  $\text{HSO}_4^-$   
(c)  $\text{SO}_3$  (d)  $\text{SO}_3^+$

## 9. Aromatic compounds burn with sooty flame because:

- (a) They have high percentage of hydrogen  
(b) They have a ring structure  
(c) They have high percentage of carbon  
(d) They resist reaction with air

## 10. The conversion of n-hexane into benzene by heating in the presence of Pt is called:

- (a) Isomerization (b) Aromatization  
(c) Dealkylation (d) Rearrangement

## 11. From Punjab Boards:-

## 1) Which is the structural formula of TNT? (LHR-2010)

- (a)  $\text{C}_6\text{H}_2(\text{NO}_2)_3\text{CH}_3$  (b)  $\text{C}_6\text{H}_3(\text{NO}_2)_3\text{CH}_3$   
(c)  $\text{C}_6\text{H}_4(\text{NO}_2)_3\text{CH}_3$  (d)  $\text{C}_6\text{H}_2(\text{NO}_2)_3\text{C}_3\text{H}_7$

## 2) How many resonance structures of benzene are known? (LHR-2012-I)

- (a) 3 (b) 4  
(c) 5 (d) 6

## 3) Resonance energy of benzene is: (LHR-2012-II)

- (a) 150.5 kJ/mol (b) 140.5 kJ/mole  
(c) 155 kJ/mole (d) 145 kJ/mole

## 4) Amongst the following the compound that can be most readily sulphonated is: (MTN-13)

- (a) Toluene (b) Benzene  
(c) Nitrobenzene (d) Chlorobenzene

5) Toluene  $\xrightarrow[100^\circ\text{C}]{\text{HNO}_3 + \text{H}_2\text{SO}_4}$  : (LHR-2014-I)

- (a) o-nitrotoluene (b) m-nitrotoluene  
(c) p-nitrotoluene (d) 2, 4, 6-TNT

## 6) Aromatic hydrocarbons are the derivatives of: (LHR-2014-II)

- (a) Normal series of paraffins  
(b) Alkene  
(c) Benzene (d) Cyclohexane

## 7) Molecule of benzene contains: (GRW-2011)

- (a) Three double bonds  
(b) Two double bonds  
(c) One double bond  
(d) Delocalized  $\pi$ -electron charge

## 8) Nitration of toluene takes place at:

- (a) m-position (b) P-position  
(c) O-position  
(d) Both O-position and P-position

## 9) The Benzene molecule contains: (MUL-2016)

- (a) Three double bonds  
(b) Two double bonds  
(c) One double bond  
(d) Delocalized  $\pi$ -electron charge

## 10) m-Chloronitro benzene is prepared by: (BWP-2014)

- (a) nitration of chloro benzene  
(b) nitration of benzene  
(c) chlorination of nitrobenzene  
(d) nitration of m-chloro benzene

## 11) Benzene can not undergo: (BWP-2014), (GRW-13), (LHR-13, 16), (RWP-16, 18), (FSD-17), (SAH-18), (SGD-18)

- (a) substitution reactions  
(b) addition reactions  
(c) oxidation reactions  
(d) elimination reactions



12) The conversion of n-hexane into benzene by heating in the presence of Pt is called:

(BWP-2015)

- a) isomerization      b) aromatization  
c) dealkylation      d) rearrangement

13) The electrophile in aromatic sulphonation is :

(BWP-2017, 18), (FSD-14, 15, 18),  
(GRW-15), (MTN-15), (SAH-17)

- a)  $\text{H}_2\text{SO}_4$       b)  $\text{HSO}_4^-$   
c)  $\text{SO}_3$       d)  $\text{SO}_3^+$

14) During nitration of benzene, the active nitrating agent is:

(FSD-2013)

- a)  $\text{NO}_2^+$       b)  $\text{NO}_3^-$   
c)  $\text{NO}_2$       d)  $\text{BF}_3$

15) Which compound is the most reactive one?

(RWP-2015), (DGK-13, 17),  
(SGD-13, 17), (LHR-15)

- a) Benzene      b) Ethyne  
c) Ethene      d) Ethane

16) Which of the following is ortho and para directing group?

(SGD-2014)

- a)  $-\text{I}$       b)  $-\text{CHO}$   
c)  $\text{NR}_3^+$       d)  $-\text{COOH}$

17) During nitration of benzene, the active nitrating agent is:

(SGD-2016-II),

(GRW-14, 17), (DGK-15, 17), (LHR-16)

- a)  $\text{NO}_3^+$       b)  $\text{HNO}_3$   
c)  $\text{NO}_2^-$       d)  $\text{NO}_2^+$

18) The C - C bond length in benzene is:

(DGK-2012)

- a)  $1.32\text{\AA}$       b)  $1.397\text{\AA}$   
c)  $1.20\text{\AA}$       d)  $1.54\text{\AA}$

19) Which is not a meta directing group?

(DGK-2015)

- a)  $-\text{COOH}$       b)  $-\text{CHO}$   
c)  $-\text{COR}$       d)  $-\text{NH}_2$

20) Which of the following acid can be used as a catalyst in Friedel-Crafts reactions:

(AJK-2016), (DGK-14), (BWP-16),  
(SGD-16), (MTN-17, 18), (RWP-17),

- a)  $\text{AlCl}_3$       b)  $\text{HNO}_3$   
c)  $\text{BeCl}_2$       d)  $\text{NaCl}$

### III) From Entry Test-

(1) Which of the following acid can be used as catalyst in Friedel Craft's reaction:

- (a)  $\text{AlCl}_3$       (b)  $\text{HNO}_3$   
(c)  $\text{BeCl}_2$       (d)  $\text{NaCl}$

(2) During nitration of benzene, the active nitrating agent is:

- (a)  $\text{NO}_3$       (b)  $\text{NO}_2^+$   
(c)  $\text{NO}_2^-$       (d)  $\text{HNO}_3$

(3) The electrophile in aromatic sulphonation is:

- (a)  $\text{H}_2\text{SO}_4$       (b)  $\text{HSO}_4^-$   
(c)  $\text{SO}_3^+$       (d)  $\text{SO}_3$

(4) Hydrogen to carbon ratio in aromatic hydrocarbons is:

- (a) Low      (b) High  
(c) Equal      (d) None

(5) The second substitution in benzene ring would give rise isomeric products:

- (a) One      (b) Two  
(c) Three      (d) Four

(6) Molecular mass of benzene is determined by:

- (a) Vapour density method  
(b) X-ray diffraction  
(c) Elemental analysis  
(d) Degradation method

(7) C - H bond lengths in benzene are:

- (a)  $0.99\text{\AA}$       (b)  $1.09\text{\AA}$   
(c)  $1.12\text{\AA}$       (d)  $1.397\text{\AA}$

(8) Each carbon in benzene ring is hybridized:

- (a) sp      (b)  $\text{sp}^2$   
(c)  $\text{sp}^3$       (d) None of these

(9) On hydrogenation benzene liberates energy:

- (a)  $358.5\text{ kJ/mole}$       (b)  $119\text{ kJ}\cdot\text{mol}^{-1}$   
(c)  $208\text{ kJ}\cdot\text{mol}^{-1}$       (d)  $150.5\text{ kJ}\cdot\text{mol}^{-1}$

(10) The benzene ring is oxidized to maleic anhydride when strongly heated with:

- (a)  $\text{Ni}/200^\circ\text{C}$       (b)  $\text{V}_2\text{O}_5/450^\circ\text{C}$   
(c)  $\text{AlCl}_3/150^\circ\text{C}$       (d) Sunlight

(11) Main source of aromatic compound is:

- (a) Petroleum      (b) Coal tar  
(c) Living organism



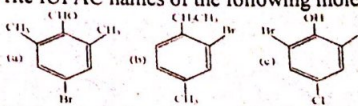
- (d) Dead marine animals
- (12) When acetylene is heated at  $300^{\circ}\text{C}$  in Cu-tube, the product obtained is:  
 (a) Benzene (b) Thiophene  
 (c) Divinyl acetylene  
 (d) Xylene
- (13) Which one of the following species is ortho and para director:  
 (a) CHO (b)  $\text{SO}_3\text{H}$   
 (c)  $\text{NO}_2$  (d) Cl
- (14) The carbon-carbon bond distance in benzene:  
 (a)  $1.54^{\circ}\text{\AA}$  (b)  $1.34^{\circ}\text{\AA}$   
 (c)  $1.2^{\circ}\text{\AA}$  (d)  $1.397^{\circ}\text{\AA}$
- (15) In toluene, synthesis by Friedel Craft, the reactants in addition to anhydrous  $\text{AlCl}_3$  are:  
 (a)  $\text{C}_6\text{H}_6 + \text{CH}_4$  (b)  $\text{C}_6\text{H}_5\text{Cl}$   
 (c)  $\text{C}_6\text{H}_6 + \text{CH}_3\text{Cl}$  (d)  $\text{C}_6\text{H}_5\text{Cl} + \text{CH}_4$
- (16) Benzophenone is also known as:  
 (a) Biphenyl (b) Dimethyl Ketone  
 (c) Diphenyl Ketone  
 (d) Methylphenyl Ketone
- (17) The no. of possible isomers of xylene are:  
 (a) 2 (b) 3  
 (c) 4 (d) 5
- (18) The molecular formula of naphthalene is:  
 (a)  $\text{C}_{10}\text{H}_8$  (b)  $\text{C}_{10}\text{H}_{10}$   
 (c)  $\text{C}_{10}\text{H}_{12}$  (d)  $\text{C}_{12}\text{H}_{12}$
- (19) Chlorine reacts with benzene in the presence of sunlight to give:  
 (a) Chlorobenzene  
 (b) Benzoyl chloride  
 (b) Ortho-para dichlorobenzene  
 (d) Hexachlorobenzene
- (20) Effect of substituent on benzene ring is due to:  
 (a) Resonance  
 (b) Inductive effect  
 (c) Both (a) and (b)  
 (d) Unpredictable

## SECTION II

### SHORT QUESTIONS

#### From Exercise:-

#### QUESTIONS

- What happens when: Benzene is heated with conc.  $\text{H}_2\text{SO}_4$  at  $80^{\circ}\text{C}$ .
- What happens when: Chlorine is passed through benzene in sunlight.
- What happens when: A mixture of benzene vapours and air are passed over heated vanadium pentaoxide.
- What happens when: Benzene is burnt in free supply of air.
- What is meant by the terms.  
 (i) Aromatic (ii) Oxidation  
 (iii) Sulphonation (iv) Nitration  
 (v) Halogenation
- (a) Draw structural formulas for the following compounds.  
 (i) m-Chlorobenzoic acid  
 (ii) p-Hydroxybenzoic acid  
 (iii) o-Bromonitrobenzene  
 (iv) o-Ethyltoluene  
 (v) p-Nitroaniline  
 (vi) 2,4,6-Trinitrotoluene  
 (vii) m-Nitrophenol  
 (viii) p-Dibenzylbenzene  
 (ix) 2-Amino-5-bromo-3-nitrobenzene sulphonic acid
- Give names and the possible isomeric structures of the following;  
 (i) Xylenes (ii) Trimethylbenzene  
 (iii) Bromonitrotoluene
- Write IUPAC names of the following molecules.  

- Give general mechanism of the electrophilic aromatic substitution reactions.
- Predict the major products of bromination of the following compounds.  
 (a) Toluene (b) Nitrobenzene  
 (c) Bromobenzene (d) Benzoic acid  
 (e) Benzaldehyde (f) Phenol



10. Explain classification of aromatic hydrocarbons on the basis of number of rings. (GRW-2016)
11. What is resonance? Explain structure of benzene by resonance method. (GRW-2017)
12. Discuss the structure of benzene. How is the open chain structure ruled out? (MTN-2014)
13. Write the atomic orbital treatment about the structure of benzene. (MTN-2015)
14. Describe Nitration and Sulphonation of Benzene with mechanism. (MTN-2017)
15. Write four reactions in which benzene behaves as if it is a saturated hydrocarbon. (FSD-2013)
16. Write the mechanism of halogenation of benzene. (FSD-2014)
17. Describe the structure of benzene on the basis of resonance method. (RWP-2014), (LHR-12)
18. What are aromatic hydrocarbons? How are they classified? (RWP-2015)
19. Predict the major products of bromination of following compounds alongwith reaction conditions. (RWP-2016)
  - (i) Nitro benzene (ii) Benzaldehyde
  - (iii) Bromobenzene (iv) Phenol
20. Describe the structure of Benzene on the basis of atomic orbital treatment. (RWP-2017, 18), (GRW-13, (SGD-13))
21. Write down the mechanisms of the following reactions. (SGD-2017), (SAH-18), (RWP-18)
  - (i) Friedel - Craft's alkylation
  - (ii) Nitration of benzene
22. What are alkylation
  - (i) Friedel aromatic hydrocarbons? Classify them and give one example of each class. (DGK-2011, 2015)
23. Detail out two reactions in which benzene behave as saturated hydrocarbon and two reactions if behave as unsaturated. (DGK-2012), (DGK-18), (LHR-18)
24. What are Friedel - craft's reaction. Give mechanism with example of Friedel- Craft's acylation reaction. (GRW-12), (DGK-2013, 17), (LHR-11, 13), (MTN-13), (BWP-14, 15), (SGD-16)
25. What is sulphonation? Give its mechanism. (SAH-2014), (SGD-18)
26. Write the mechanism of nitration and alkylation of benzene. (SAH-2015), (FSD-17),

27. How will you convert benzene into? (SAH-2017), (DGK-16)

- (i) p-chloronitrobenzene
- (ii) m-chloronitrobenzene



## Chapter — 10

### ALKYL HALIDES

#### SECTION I

#### Multiple Choice Questions

##### (I) From Exercise:

1. In primary alkyl halides, the halogen atom is attached to a carbon which is further attached to how many carbon atoms.
  - (a) Two (b) Three
  - (c) One (d) four
5.  $S_N2$  reactions can be best carried out with:
  - (a) Primary alkyl halides
  - (b) Secondary alkyl halides
  - (c) Tertiary alkyl halides
  - (d) All the three
6. Elimination bimolecular reactions involve:
  - (a) first order kinetics
  - (b) second order kinetics
  - (c) third order kinetics
  - (d) zero order kinetics
7. For which mechanisms, the first step involved is the same:
  - (a)  $E1$  and  $E2$  (b)  $E2$  and  $S_N2$
  - (c)  $S_N1$  and  $E2$  (d)  $E1$  and  $S_N1$
8. Alkyl halides are considered to be very reactive compounds towards nucleophiles because:
  - (a) they have an electrophilic carbon
  - (b) they have an electrophilic carbon and a good leaving group
  - (c) they have an electrophilic carbon and a bad leaving group
  - (d) they have a nucleophilic carbon and good leaving group
9. The rate of  $E1$  reaction depends upon:
  - (a) the concentration of substrate
  - (b) the concentration of nucleophile
  - (c) the concentration of substrate as well as nucleophile
  - (d) None of the above



10. Which one of the following is not a nucleophile?

- (a)  $\text{H}_2\text{O}$  (b)  $\text{H}_3\text{S}$   
(c)  $\text{BF}_3$  (d)  $\text{NH}_3$

**(II) From Punjab Boards:-**

1)  $\text{S}_{\text{N}}1$  reaction are given by: (LHR-2012-II), (GRW-11)

- a) Primary alkyl halides  
b) Secondary alkyl halides  
c) Tertiary alkyl halides  
d) Secondary alcohols

2) Elimination bimolecular reactions involve: (GRW-2016), (MUL-14), (SAH-18)

- a) first order kinetics  
b) second order kinetics  
c) third order kinetics  
d) zero order kinetics

3) In Primary Alkyl Halides, the Halogen atom is attached to a Carbon, which is further attached to \_\_\_ Carbon Atoms: (MUL-2016)

- a) Two b) Three  
c) One d) Four

4) Which one is the best leaving group? (FSD-2015)

- a)  $\text{I}^-$  b)  $\text{Br}^-$   
c)  $\text{Cl}^-$  d)  $\text{F}^-$

5) For which mechanisms, the first step is the same? (RWP-2016), (LHR-13, 16), (MTN-14), (DGK-15, 16), (GRW-17), (BWP-18)

- a)  $\text{E}_1$  and  $\text{E}_2$  b)  $\text{E}_2$  and  $\text{S}_{\text{N}}2$   
c)  $\text{S}_{\text{N}}1$  and  $\text{E}_2$  d)  $\text{E}_1$  and  $\text{S}_{\text{N}}1$

6)  $\text{S}_{\text{N}}2$  reactions can be best carried out with: (DGK-17)

- (a) Primary alkyl halides  
(b) Secondary alkyl halides  
(c) Tertiary alkyl halides  
(d) All the three

7) Which one of the following is best nucleophile? (SGD-2016-II)

- a)  $\text{H}_2\text{O}$  b)  $\text{NH}_3$   
c)  $\text{C}_2\text{H}_5\text{O}^-$  d)  $\text{NO}$

8) Which one of the following is not a nucleophile? (DGK-2012)

- a)  $\text{H}_2\text{S}^-$  b)  $\text{NH}_3$   
c)  $\text{H}_3\text{O}^+$  d)  $\text{CN}^-$

9) Which one of the following is not a nucleophile? (LHR-12), (SAH-2017-II), (DGK-11, 14, 15), (FSD-13, 17), (BWP-14, 15), (RWP-17), (MTN-17)

- (a)  $\text{H}_2\text{O}$  (b)  $\text{H}_2\text{S}$   
(c)  $\text{BF}_3$  (d)  $\text{NH}_3$

**(III) From Entry Tests:-**

(1) Best reagent for preparing a chloroalkane from alcohol is:

- (a)  $\text{SOCl}_2$  (b)  $\text{ZnCl}_2 / \text{HCl}$   
(c)  $\text{PCl}_3$  (d)  $\text{Cl}_2 / \text{CCl}_4$

(2) When propene is heated at  $800^\circ\text{C}$  in the presence of  $\text{Cl}_2$ , it gives the following compound:

- (a) Polyvinyl chloride  
(b) 1, 2 dichloropropane  
(c) Allyl chloride  
(d) No reaction

(3) The reactivity of halogen atom is maximum

- (a) Propyl-chloride  
(b) Propyl-bromide  
(c) Isopropyl chloride  
(d) Isopropyl-bromide

(4) Which is least reactive in a nucleophilic substitution reaction?

- (a)  $\text{CH}_2 = \text{CHCl}$   
(b)  $\text{C}_2\text{H}_5\text{Cl}$   
(c)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{Cl}$   
(d)  $(\text{CH}_3)_3\text{C} - \text{Cl}$

(5) Which of the following is a liquid at room temperature?

- (a)  $\text{C}_2\text{H}_5\text{Cl}$  (b)  $\text{CH}_3\text{Cl}$   
(c)  $\text{C}_2\text{H}_5\text{Br}$  (d)  $\text{CH}_3\text{Br}$

(6) Ethyl chloride reacts with  $\text{Ag}_2\text{O}$  in the presence of moisture to form:

- (a) Ethanol (b) Ether  
(c) Acetic acid (d) Acetone

(7) Alkyl halides react with Zn-metal to form alkanes. The reaction is called:

- (a) Wurtz's reaction  
(b) Clemmensen's reaction  
(c) Frankland's reaction  
(d) Wolf-Kishner's reaction



(8) Alkyl halides are prepared by reacting alcohols with:

- (a) HX (b)  $\text{SOCl}_2$   
(c)  $\text{PCl}_5$  (d) All a, b, c

(9) Which compound forms alkanes when alkylhalides react with:

- (a) Alcoholic KOH  
(b)  $\text{Zn} + \text{HCl}$   
(c) Soda lime  
(d) Soda-ash

(10) Which of the following alkyl halide is the most reactive towards the attacking nucleophile:

- (a)  $\text{CH}_3\text{F}$  (b)  $\text{CH}_3\text{Cl}$   
(c)  $\text{CH}_3\text{Br}$  (d)  $\text{CH}_3\text{I}$

(11) Which of the following is not nucleophile?

- (a)  $\text{H}_2\ddot{\text{O}}$  (b)  $\text{H}_2\text{S}^-$   
(c)  $\text{BF}_3$  (d)  $\ddot{\text{N}}\text{H}_3$

(12) Carbocation is a/an:

- (a) Electrophile (b) Nucleophile  
(c) Free radical (d) Group of atoms

(13) 1-bromobutane on reaction with alcoholic potassium hydroxide gives:

- (a) 1-butanol (b) 1-butene  
(c) 2-butene (d) 1-butyne

(14)  $\text{S}_\text{N}2$  reaction can be best carried out with:

- (a) Primary alkyl halide  
(b) Secondary alkyl  
(c) Tertiary alkyl halide  
(d) All of above

(15) In the transition state of  $\text{S}_\text{N}2$  mechanism reaction with alkyl halides, which of the following orbital hybridization is involved:

- (a)  $\text{sp}^3$  (b)  $\text{sp}^2$   
(c) sp (d)  $\text{dsp}^2$

(16) Which of the following factors does not affect the  $\text{S}_\text{N}1$  rate is:

- (a) Nucleophilicity of the attacking nucleophile  
(b) Stability of the carbonium ion  
(c) Solvent system  
(d) The nature of leaving group

(17) In  $\beta$ -elimination reaction, nucleophile attacks on:

- (a)  $\alpha$ -hydrogen (b)  $\beta$ -hydrogen  
(c) Hydrogen (d)  $\alpha$ -carbon

(18) The substances which donates a pair of electron to electrophile are called:

- (a) Electrophile (b) Nucleophile  
(c) Lewis acid (d) Dibasic acid

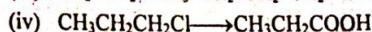
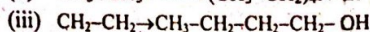
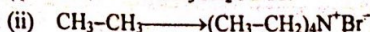
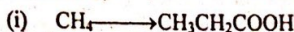
## SECTION II

### SHORT QUESTIONS

From Exercise:-

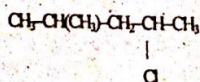
### QUESTIONS

- Define alkyl halide. Which is the best method of preparing alkyl halide?
- Give IUPAC names to the following compounds.
- Draw all the possible structures that have the molecular formula  $\text{C}_6\text{H}_{13}\text{Cl}$ . Classify each as primary, secondary or tertiary chloride. Give their names according to IUPAC system.
- Using ethyl bromide as a starting material how would you prepare the following compounds. Give also the inorganic reagents and conditions necessary to carry out these reactions:  
(a) n-butane (b) Ethyl alcohol  
(c) Ethyl cyanide (d) Ethane  
(e) Ethene (f) Propanoic acid  
(g) Propane
- What do you understand by the term  $\beta$ -elimination reaction? Explain briefly the two possible mechanisms of  $\beta$ -elimination reaction.
- How will you carry out the following conversions?



### ANSWERS

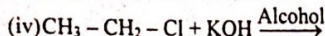
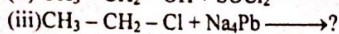
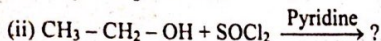
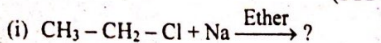
- Alkyl Halide:** Halogen derivatives of alkanes are called haloalkanes. They may be mono, di, tri or poly haloalkanes depending upon the no. of halogen atoms present in the molecule. Among these, monohaloalkanes are also called alkyl halides.
- 



2-chloro,  
4-methyl pentane



- Explain Nucleophilic substitution Unimolecular reaction ( $S_N1$ ) with example. (MTN-2016-II), (SAH-14), (GRW-15), (RWP-15), (BWP-15)
- What are  $S_N$  reactions? Explain  $S_N2$  reactions in detail. (MTN-2017), (DGK-12, 13), (GRW-13), (LHR-16), (RWP-17), (BWP-18), (SGD-18)
- Explain  $E1$  reaction with example. (BWP-2015)
- What products are formed when Grignard's reagent react with alcohol, formaldehyde and water? (FSD-2014)
- Give methods to prepare alkyl halides from alcohols. (FSD-2015), (GRW-10)
- Discuss two main factors which govern reactivity of alkyl halides. (RWP-2016)
- Complete the following chemical reactions: (SGD-2016)



- How will you prepare following compounds from Ethyl bromide? (SGD-2017)
  - n-Butane
  - Ethane
  - Ethene
  - Propanoic acid
- What are  $\beta$  elimination reactions? Discuss their types. (DGK-2015), (FSD-13), (SGD-13), (LHR-13), (MUL-14, 18)
- Write down reactions of  $\text{CH}_3 - \text{CH}_2 - \text{Cl}$  with: (DGK-2016)
  - Na
  - Zn + HCl
  - $\text{Na}_4\text{Pb}$
  - Mg
- Write a note on mechanism of bimolecular substitution reactions. (DGK-2017)
- Explain  $E2$  mechanism in detail. (SAH-2017)

## Chapter — 11

## ALCOHOLS, PHENOLS AND ETHERS

### SECTION I

### Multiple Choice Questions

#### I) From Exercise:-

- Which compound shows hydrogen bonding?
  - $\text{C}_2\text{H}_6$
  - $\text{C}_2\text{H}_5\text{Cl}$
  - $\text{CH}_3 - \text{O} - \text{CH}_3$
  - $\text{C}_2\text{H}_5\text{OH}$

- Which compound show maximum hydrogen bonding with water?
  - $\text{CH}_3\text{OH}$
  - $\text{C}_2\text{H}_5\text{OH}$
  - $\text{CH}_3 - \text{O} - \text{CH}_3$
  - $\text{C}_6\text{H}_5\text{OH}$
- Which compound is more soluble in water?
  - $\text{C}_2\text{H}_5\text{OH}$
  - $\text{C}_6\text{H}_5\text{OH}$
  - $\text{CH}_3\text{COCH}_3$
  - n-Hexanol
- Which compound will have the maximum repulsion with  $\text{H}_2\text{O}$ ?
  - $\text{C}_6\text{H}_6$
  - $\text{C}_2\text{H}_5\text{OH}$
  - $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
  - $\text{CH}_3 - \text{O} - \text{CH}_3$
- Ethanol can be converted into ethanoic acid by
  - Hydrogenation
  - Hydration
  - Oxidation
  - Fermentation
- Which enzyme is not involved in fermentation of starch?
  - Diastase
  - Zymase
  - Urease
  - Invertase
- Which compound is called a universal solvent?
  - $\text{H}_2\text{O}$
  - $\text{CH}_3\text{OH}$
  - $\text{C}_2\text{H}_5\text{OH}$
  - $\text{CH}_3 - \text{O} - \text{CH}_3$

#### II) From Punjab Boards:-

- Methanol can be prepared from hydrogenation of: (LHR-2011)
  - $\text{CH}_3\text{CN}$
  - $\text{CH}_3\text{Br}$
  - $\text{HCHO}$
  - $\text{CH}_3\text{CHO}$
- Order of reactivity of alcohols when C-O bond broken is: (LHR-2012-II)
  - Tertiary alcohols > Secondary alcohols > Primary alcohols
  - Primary alcohols > Secondary alcohols > Tertiary alcohol
  - Secondary alcohols > Primary alcohols > Tertiary alcohols
  - Tertiary alcohols > Primary alcohols > Secondary alcohols
- Alcohol obtained by fermentation is only upto: (LHR-2014-I)
  - 10%
  - 12%
  - 20%
  - 95%
- Which enzyme is not involved in fermentation of starch? (LHR-2015-II)
  - Diastase
  - Zymase
  - Urease
  - Invertase



Which compound is more soluble in water?  
(LHR-2016-1)

- a)  $C_2H_5OH$                       b)  $C_6H_5OH$   
c)  $CH_3COCH_3$                       d) n-Hexanol

Which liquid is called wood spirit?  
(GRW-11, 18)

- a)  $CH_3OH$                       b)  $C_2H_5OH$   
c)  $CH_3COOH$                       d)  $CH_3-O-CH_3$

Alcohol obtained by fermentation never exceeds:  
(GRW-2012)

- a) 10%                      b) 16%  
c) 14%                      d) 95%

Methyl alcohol is not used: (GRW-2014)

- a) as a solvent  
b) as an antifreezing agent  
c) as a substitute for petrol  
d) for denaturing of ethyl alcohol

Which compound is called universal solvent?  
(GRW-2016), (MTN-14)

- a)  $H_2O$                       b)  $CH_3OH$   
c)  $C_2H_5OH$                       d)  $CH_3-O-CH_3$

Enzyme involved in fermentation of starch is:  
(MTN-2013)

- a) Diastase                      b) Zymase  
c) Urease                      d) Invertase

Which Compound shows maximum hydrogen bonding with water? (MTN-2016), (LHR-13, 14), (GRW-15), (SGD-15), (BWP-16)

- a)  $C_2H_6$                       b)  $C_2H_5Cl$   
c)  $CH_3-O-CH_3$                       d)  $C_2H_5OH$

Which of the following is weakest acid?  
(BWP-2014)

- a) Phenol                      b) Benzoic acid  
c) Ethyl alcohol                      d) Water

Ketones are prepared by Oxidation of:  
(BWP-2016)

- a) Primary Alcohol  
b) Tertiary Alcohol  
c) Secondary Alcohol  
d) Carboxylic Acid

Which one is dihydric alcohol? (RWP-2015)

- a) Ethanol                      b) Cyclohexanol  
c) Glycerol                      d) Glycol

The most reactive alcohol when O-H bond breaks is:  
(SGD-2014)

- a) Tertiary alcohol  
b) Secondary alcohol  
c) Primary alcohol  
d) Methyl alcohol

16) Which one will show the maximum repulsion with water? (DGK-2015, 18), (FSD-14), (BWP-18)

- a)  $C_6H_6$                       b)  $C_2H_5OH$   
c)  $CH_3CH_2CH_2OH$                       d)  $CH_3OCH_3$

17) Ethanol can be converted into ethanoic acid by:  
(AJK-2016), (DGK-11, 17), (SGD-13, 16), (BWP15), ((RWP-16, 17)

- a) Hydrogenation                      b) Hydration  
c) Oxidation                      d) Fermentation

### III) From Entry Test:-

(1) Which is most acidic?

- (a)  $H_2O$                       (b)  $CH_3OH$   
(c)  $C_2H_5OH$                       (d)  $CH_3-CH_2-CH_2OH$

(2) Alcohols of low molecular weight are:

- (a) Soluble in water  
(b) Soluble in water on heating  
(c) Insoluble in water  
(d) Insoluble in all solvents

(3) The intermediate in acid catalysed dehydration of alcohol is:

- (a) Carbene                      (b) Carbanion  
(c) Carbocation                      (d) Free radical

(4) The reagent used for testing phenolic group is:

- (a)  $FeCl_3$                       (b)  $NH_4NO_3$   
(c) Na                      (d)  $CH_3COCl$

(5) Primary alcohols can be prepared from Grignard's reagent by reacting with:

- (a) Oxygen                      (b)  $HCHO$   
(c) Ethylene oxide                      (d) All of these

(6) Aldehydes after catalytic reduction change to:

- (a)  $p^\circ$  alcohol                      (b)  $s^\circ$  alcohol  
(c)  $t^\circ$  alcohol                      (d)  $p^\circ$  and  $S^\circ$  alcohol

(7) Which of the following alcohol is commonly used as anti-freeze?

- (a) Methanol                      (b) Ethanol  
(c) Ethylene glycol                      (d) All of the above

(8) Which of the following will have the highest boiling point?

- (a) Methanal                      (b) Ethanal  
(c) Propanal                      (d) 2-hexanone

(9) Which of the following alcohol is used in the perfumes and for flavouring:

- (a) Methanol                      (b) Ethanol  
(c) 1-propanol                      (d) 1-butanol

(10) The hydrolysis of sugar is called:

- (a) Condensation                      (b) Polymerization  
(c) Inversion                      (d) Reduction



(11) Which statement is incorrect about phenol:

- (a) It is colourless, crystalline poisonous solid
- (b) It does not turn blue litmus paper red
- (c) It liberates  $\text{CO}_2$  gas from carbonate
- (d) Above  $65.9^\circ\text{C}$  it is misible wither water

(12) Which of the following is the weakest acid:

- (a) Phenol
- (b) Alcohol
- (c) Carboxylic acid
- (d) Water

(13) Which inorganic reagent may be used to distinguish between phenol and methanol:

- (a) Alkaline aqueous  $\text{I}_2$
- (b) Aqueous  $\text{NaHCO}_3$
- (c)  $\text{K}_2\text{Cr}_2\text{O}_7$  in dil.  $\text{H}_2\text{SO}_4$
- (d) Na

(14) Phenol is also called:

- (a) Carbonic acid
- (b) Carbollic acid
- (c) Carboxylic acid
- (d) Fatty acid

## SECTION II

### SHORT QUESTIONS

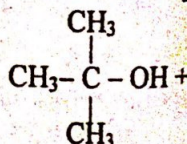
From Exercise:-

### QUESTIONS

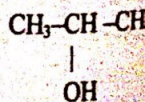
- What are alcohols? How are they classified? How will you distinguish between primary, secondary and tertiary alcohols?
- How is methyl alcohol obtained on large scale? How it may be distinguished from ethyl alcohol?
- What is fermentation? Which compound may be obtained on industrial scale by fermentation?
- Explain the following terms:
  - (i) Absolute alcohol
  - (ii) Methylated spirit
  - (iii) Rectified spirit
  - (iv) Denaturing of alcohols
- How does ethylalcohol react with the following reagents?
- How will you distinguish between

- Give reasons alcohol cannot be oxidized by  $\text{KMnO}_4$  in acidic process.
- Give reasons different alcohols have different boiling points.
- Give reasons higher boiling

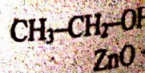
- The organic compounds which contain hydroxyl group are called alcohols. They can be classified into three types: (i) Primary alcohols, (ii) Secondary alcohols, (iii) Tertiary alcohols. They can be identified by the following tests:
  - (a) Tertiary alcohols do not give a positive result in the presence of anhydrous  $\text{ZnCl}_2$  and concentrated  $\text{HCl}$ .



- If insoluble in water for 5 minutes with  $\text{ZnCl}_2$  and concentrated  $\text{HCl}$ , then it is secondary alcohol.



- If insoluble in water but soluble in  $\text{HCl}$  in the presence of  $\text{ZnCl}_2$ , then it is primary alcohol.



- $\text{CO} + 2\text{H}_2 \xrightarrow{450^\circ\text{C}}$  Ethanol gives a positive result in the presence of  $\text{NaOH}$ .



6. How does ethyl alcohol react with following reagents: (LHR-2017), (SGD-18)  
 (i) Conc.  $\text{H}_2\text{SO}_4$  (ii) Na  
 (iii)  $\text{CH}_3\text{COOH}$  (iv)  $\text{SOCl}_2$
7. Convert methanol to ethanol and ethanol to methanol. (GRW-2014), (SGD-18)
8. How ethers are prepared and how do they react with hydrogen iodide? (GRW-2015)
9. Describe any four chemical reactions of carboxylic acid. (GRW-2016)
10. Write down two methods for preparing phenol. What is the reaction of phenol with? (GRW-2017)  
 (i) Zn (ii)  $\text{Br}_2$  water
11. Give two methods of preparation of phenol. (MTN-2015, 18), (LHR-15)
12. Give two methods of preparation of phenol. (GRW-2016)
13. Explain the following terms using Ethyl Alcohol as an example: (MTN-17), (BWP-14)  
 (i) Oxidation (ii) Dehydration  
 (iii) Esterification (iv) Ether formation
14. Write I.U.P.A.C. names of following. Compounds are given: (BWP-2017)  
 (i)  $(\text{CH}_3)_3\text{C}-\text{OH}$   
 (ii)  $\text{CH}_3-\text{O}-\text{CH}_2-\text{CH}_2-\text{CH}_3$   
 (iii)  $\begin{array}{c} \text{CH}_2-\text{CH}_2 \\ | \quad | \\ \text{OH} \quad \text{OH} \end{array}$   
 (iv)  $(\text{CH}_3)_2-\text{CH}_2-\underset{\text{CH}_3}{\text{CH}}-\text{OH}$
15. Write the reactions of ethyl alcohol with Na,  $\text{SOCl}_2$ ,  $\text{NH}_3$ ,  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ . (FSD-2014)
16. Write structural formula of: (FSD-2017)  
 (i) Glycerol (ii) Carboxylic acid  
 (iii) Sodium Ethoxide (iv) Propoxy propane
17. How will you convert: (i) Ethanol into methane (ii) Ethanol into ethanal (iii) Ethanol into ethane (iv) Ethanol into diethyl ether. (RWP-2014), (MTN-18)
18. Prepare ethyl acetate, ethanal, ethane and diethyl ether from ethanol. (RWP-2016)
19. Describe industrial preparation of ethanol. How will you distinguish between ethanol and methanol. (SGD-2014)
20. Describe the industrial method of preparation of methanol. (SGD-2015), (MTN-15)
21. Give the reactions of phenol with the following: (SGD-2017), (FSD-15), (DGK-15), (SAH-18), (RWP-18)  
 (i) Zn (ii) bromine water  
 (iii) Conc.  $\text{HNO}_3$  (iv) Conc.  $\text{H}_2\text{SO}_4$
22. Give two reactions in each case in which C-O and O-H bonds of alcohol are broken. (DGK-2015)
23. Write two methods for the preparation of phenol. (DGK-2016)
24. How is phenol prepared from? (DGK-2017)  
 (i) Chlorobenzene  
 (ii) Sodium salt of benzene sulphonic acid
25. Give industrial preparation of ethyl alcohol. (SAH-2014), (RWP-17)
26. Describe acidic behaviour of phenol. (SAH-2017)



## Chapter — 12

### ALDEHYDES AND KETONES

#### SECTION I

#### Multiple Choice Questions

##### (I) From Exercise:-

- The carbon atom of a carbonyl group is.
  - sp hybridized
  - sp<sup>2</sup> hybridized
  - sp<sup>3</sup> hybridized
  - none of these
- Formalin is
  - 10% solution of formaldehyde in water
  - 20% solution of formaldehyde in water
  - 40% solution of formaldehyde in water
  - 60% solution of formaldehyde in water
- Which of the following will have the highest boiling point?
  - methanal
  - Ethanal
  - propanal
  - 2-Hexanone
- Ketones are prepared by the oxidation of.
  - primary alcohol
  - secondary alcohol
  - tertiary alcohol
  - none of these



5 Acetone reacts with HCN to form a cyanohydrin. It is an example of.

- Electrophilic addition
- Electrophilic substitution
- Nucleophilic addition
- Nucleophilic substitution

6 Which of the following compounds will not give iodoform test on treatment with  $I_2 / NaOH$ .

- Acetaldehyde
- Acetone
- Butanone
- 3-pentanone

7 Which of the following compounds will react with Tollen's reagent?

- $CH_3 - \overset{\overset{O}{\parallel}}{C} - H$
- $CH_3 - \overset{\overset{O}{\parallel}}{C} - CH_3$
- $CH_3 - \overset{\overset{O}{\parallel}}{C} - OH$
- $CH_3 - \overset{\overset{O}{\parallel}}{C} - CH_2 - CH_3$

8 Cannizzaro's reaction is not given by.

- Formaldehyde
- Acetaldehyde
- Benzaldehyde
- Trimethyl acetaldehyde

9 Which of the following reagents will react with both aldehydes and ketones?

- Grignard reagent
- Tollen's reagent
- Fehling's reagent
- Benedict's reagent

10 From Punjab Boards:-

1) Acetone reacts with HCN to form cyanohydrin. It is an example of:  
(LHR-2010), (DGK-12), (SGD-13)

- Electrophilic addition
- Electrophilic substitution
- Nucleophile addition
- Nucleophilic substitution

2) Addition of alcohol in carbonyl compounds give acetal; the geometry of acetal is:  
(LHR-2011)

- Linear
- Trigonal
- Tetrahedral
- Planar

3) Aldehydes and ketones react with 2, 4 dinitrophenyl hydrazine solution to give precipitate of the colour: (LHR-2012-II)

- Yellow or red
- Orange or red
- White or red
- Black or red

4) The compound used in the processing of anti polio vaccine is: (LHR-2012-II)

- Acetaldehyde
- Formaldehyde
- Acetone
- Ethyl bromide

5) Which is most difficult to oxidize?

(LHR-2013-I)

- $C_2H_5CHO$
- $CH_3CHO$
- $HCHO$
- $CH_3COCH_3$

6) Which of the following reagents will react with both aldehydes and ketones?

(LHR-2015-I, 13),

(GRW-13, 15), (MTN-13, 14),

(DGK-13, 15), (SGD-14), (RWP-15)

- Grignard reagent
- Tollen's reagent
- Fehling's reagent
- Benedict's reagent

7) Aldehydes react with hydroxylamine in acidic solution to give: (LHR-2015-II)

- An oxime
- Aldol
- Polymer
- Acetic acid

8) The carbon atom of a carbonyl group is hybridized: (LHR-2016-I), (FSD-15),

(GRW-15, 17), (MTN-17)

- $sp$
- $sp^2$
- $sp^3$
- $dsp^2$

9) Catalyst used for the laboratory preparation of formaldehyde is:

(GRW-2010)

- $\xrightarrow{Cd - Asbestos}$
- $\xrightarrow{Pb - Asbestos}$
- $\xrightarrow{Pt - Asbestos}$
- $\xrightarrow{Cu - Asbestos}$

10) Silver mirror is given by: (GRW-2012)

- Aldehydes
- Ketones
- Ethers
- Acids

11) Methyl ketones are characterized by:

(GRW-2012)

- Tollen's reagent
- Iodoform test
- Benedict's reagent
- Fehling solution



- 12) The compound which will not give iodoform test is: (MTN-2013), (GRW-16)  
 a) Acetaldehyde b) Acetone  
 c) Butanone d) 3-Pentanone
- 13) Metaformaldehyde is prepared in the presence of which dilute acid. (BWP-2014)  
 a)  $\text{H}_2\text{SO}_4$  b)  $\text{HCl}$   
 c)  $\text{HNO}_3$  d)  $\text{H}_2\text{CO}_3$
- 14) Cannizzaro's reaction is given by: (BWP-2015)  
 a) acetaldehyde b) formaldehyde  
 c) acetone d) methyl alcohol
- 15) Aldol condensation is given by: (BWP-2017)  
 a) Acetaldehyde  
 b) Formaldehyde  
 c) Benzaldehyde  
 d) Trimethyl acetaldehyde
- 16) Aldehydes on reduction form: (FSD-2013)  
 a) Primary alcohols  
 b) Secondary alcohols  
 c) Tertiary alcohols  
 d) Ketone
- 17) Formalin is a 40% solution of (FSD-2014)  
 a)  $\text{CH}_3\text{CHO}$  b)  $\text{CH}_3\text{OH}$   
 c)  $\text{HCHO}$  d)  $\text{CH}_2\text{COCH}_3$
- 18) Ketones are prepared by the oxidation of: (RWP-2015, 2017), (SGD-13)  
 a) Primary alcohol b) secondary alcohol  
 c) tertiary alcohol d) quaternary alcohol
- 19) Which reaction is disproportionation reaction? (RWP-2016)  
 a) aldol condensation  
 b) Cannizzaro's reaction  
 c) haloform reaction  
 d) acid catalysed reaction
- 20) Which test is called silver mirror test? (RWP-2016)  
 a) Tollen's test  
 b) Fehling's test  
 c) Benedict's test  
 d) Sodium nitro prusside test

- 21) Which of the following will react with Benedict's solution? (SGD-2016-II), (LHR-15)
- a)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$   
 b)  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$   
 c)  $\text{C}_2\text{H}_5-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$   
 d)  $\text{CH}_3-\text{O}-\text{CH}_3$
- 22) Which of the following compound will have the highest boiling point? (DGK-2011, 2017), (LHR-13, 17), (MTN-16)  
 a) Methanal b) Ethanal  
 c) Propanal d) 2-hexanone
- 23) Cannizzaro's reaction is not given by: (DGK-2012, 15-II), (MTN-14), (FSD-14)  
 a)  $\text{HCHO}$  b)  $\text{CH}_3\text{CHO}$   
 c)  $\text{C}_6\text{H}_5\text{CHO}$  d) Trimethyl acetaldehyde
- 24) Cannizzaro's reaction is not given by: (AJK-2016), (LHR-12, 13), (GRW-13, 14), (SAH-17)  
 a) Formaldehyde b) Acetaldehyde  
 c) Benzaldehyde d) Trimethyl acetaldehyde
- III) From Entry Test:-**
- (1) Which of the following is least reactive?  
 (a)  $\text{HCHO}$  (b)  $\text{CH}_3\text{CHO}$   
 (c)  $\text{C}_6\text{H}_5\text{CHO}$  (d)  $\text{CH}_3\text{CH}_2\text{CHO}$
- (2) Which of the following does not react with phenyl hydrazine?  
 (a) Ethanol (b) Ethanal  
 (c) Acetone (d) Acetophenone
- (3) Which of the following will not undergo haloform reaction?  
 (a)  $\text{C}_6\text{H}_5\text{CHO}$  (b)  $\text{CH}_3\text{CHO}$   
 (c)  $\text{CH}_3\text{COCH}_3$  (d)  $\text{C}_6\text{H}_5\text{COCH}_3$
- (4) Dry distillation of calcium acetate gives:  
 (a) Acetaldehyde (b) Acetone  
 (c) Formaldehyde (d) Acetic anhydride
- (5) Mild oxidizing agent among the following  
 (a)  $\text{K}_2\text{Cr}_2\text{O}_7$  (acidified)  
 (b)  $\text{KMnO}_4$  (alkaline)  
 (c) Ammonical  $\text{AgNO}_3$   
 (d) All of above



C=O and C=C bonds are differentiated by:

- (a) Hybridization of C-atom
- (b) Planar structures
- (c) Bond length
- (d) Undergo addition reaction

Reactivity of carbonyl compounds is due to:

- (a) Electrophilic carbon
- (b) Less steric hindrance
- (c) Unsaturation of  $\text{C}=\text{O}$
- (d) All of above

For the preparation of  $\text{CH}_3\text{CHO}$  from calcium acetate we need:

- (a) 2 molecules of  $\text{Ca}(\text{CH}_3\text{COO})_2$
- (b) 1 mole of  $\text{Ca}(\text{CH}_3\text{COO})_2$  and 1 molecule of  $\text{Ca}(\text{HCOO})_2$
- (c) 2 molecules of  $\text{Ca}(\text{HCOO})_2$
- (d) None of these

Which is a mixed ketone:

- (a) Acetone
- (b) Benzophenone
- (c) Diethyl ketone
- (d) Acetophenone

Which of the following can produce ketone:

- (a) Sec-alcohol
- (b) Calcium acetate
- (c) Propyne
- (d) All of above

Which of the following is resistant to oxidation under normal condition:

- (a)  $\text{CH}_3\text{OH}$
- (b)  $\text{C}_2\text{H}_5\text{OH}$
- (c)  $\text{CH}_3\text{CHO}$
- (d)  $\text{CH}_3\text{COCH}_3$

Which of the following aldehyde is most reactive:

- (a)  $\text{HCHO}$
- (b)  $\text{CH}_3\text{CHO}$
- (c)  $\text{C}_6\text{H}_5\text{CHO}$
- (d) All of above

Ketones are prepared by the oxidation of:

- (a)  $\text{P}^\circ$  alcohol
- (b)  $\text{S}^\circ$  alcohol
- (c)  $\text{T}^\circ$  alcohol
- (d) None of these

Which of the following does not give Cannizzaro's reaction:

- (a) Formaldehyde
- (b) Acetaldehyde
- (c) Benzaldehyde
- (d) None of above

(15) Ethanal has \_\_\_\_\_ sigma bonds.

- (a) 5
- (b) 6
- (c) 7
- (d) 8

(16) Which of the following compounds is acetophenone?

- (a)  $\text{C}_6\text{H}_5\text{COCH}_3$
- (b)  $\text{C}_6\text{H}_5\text{COC}_6\text{H}_5$
- (c)  $\text{CH}_3\text{COCH}_3$
- (d)  $\text{C}_6\text{H}_5\text{CHO}$

(17) Which of the following tests is shown by ketones?

- (a) Fehling solution test
- (b) Tollen's reagent test
- (c) Schiff reagent test
- (d) Sodium nitroprusside test

(18) Which of the following will undergo nucleophilic addition reaction more easily?

- (a) Aldehyde
- (b) Alkene
- (c) Aldehyde and ketone
- (d) All of these

(19) Which of the following aldehydes is used to prepare urotropine medicine?

- (a) Acetaldehyde
- (b) Acetone
- (c) Formaldehyde
- (d) Ethyl alcohol

## SECTION II

### SHORT QUESTIONS

From Exercise:-

### QUESTIONS

- How does formaldehyde react with the following reagents?
  - (i)  $\text{CH}_3\text{MgI}$
  - (ii)  $\text{HCN}$
  - (iii)  $\text{NaHSO}_3$
  - (iv)  $\text{NaOH}$
  - (v) Hydrogen
  - (vi) Tollen's Reagent
  - (vii) Fehling's Reagent
- How does acetaldehyde reacts with following?
  - (i)  $\text{C}_2\text{H}_5\text{MgI}$
  - (ii)  $\text{HCN}$
  - (iii)  $\text{NaHSO}_3$
  - (iv) dil.  $\text{NaOH}$
  - (v)  $\text{I}_2/\text{NaOH}$
  - (vi)  $\text{NaBH}_4/\text{H}_2\text{O}$
  - (vii)  $\text{NH}_2\text{OH}$
  - (viii)  $\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}_2\text{SO}_4$
- Using ethyne as starting material how would you get acetaldehyde, acetone and ethyl alcohol?
- How would you bring about the following conversions?
  - (i) Acetone into t-Butyl alcohol
  - (ii) Propanal into 1-propanol



## Chapter — 13

## CARBOXYLIC ACIDS

## SECTION I

## Multiple Choice Questions

## From Exercise:-

Acetic acid is manufactured by:

- (a) distillation (b) fermentation  
(c) ozonolysis (d) esterification

A carboxyl acid contains:

- (a) a hydroxyl group  
(b) a carboxyl group  
(c) a hydroxyl and carboxyl group  
(d) a carboxyl and an aldehydic group

Which acid is used in the manufacture of synthetic fibre:

- (a) formic acid (b) oxalic acid  
(c) carbonic acid (d) Acetic acid

Which of the following derivative can not be prepared directly from acetic acid.

- (a) acetamide (b) acetyl chloride  
(c) acetic anhydride (d) ethyl acetate

Which reagent is used to reduce a carboxylic group to an alcohol:

- (a)  $H_2 / Ni$  (b)  $H_2 / Pt$   
(c)  $NaBH_4$  (d)  $LiAlH_4$

The solution of which acid is used for seasoning of food:

- (a) Formic acid (b) Acetic acid  
(c) Benzoic acid (d) Butanoic acid

Organic compounds X and Y react together to form organic compound Z. What type of Compounds can Z, Y and Z be?

- | X           | Y       | Z       |
|-------------|---------|---------|
| (a) alcohol | ester   | acid    |
| (b) acid    | ester   | alcohol |
| (c) ester   | alcohol | acid    |
| (d) alcohol | acid    | ester   |

8. An aqueous solution of an organic compound reacts with sodium carbonate to produce carbon dioxide gas. Which one of the following could be the organic compound:

- (a)  $CH_2=CH-CH_3$  (b)  $CH_3-CHO$   
(c)  $CH_3COOC_2H_5$  (d)  $CH_3-CH_2-COOH$

9. Which of the following is not a fatty acid?

- (a) propanoic acid (b) acetic acid  
(c) phthalic acid (d) butanoic acid

## II) From Punjab Boards:-

1) Molar mass of  $CH_3COOH$  determined in non-polar solvent is: (LHR-2011)

- a) 30 b) 60  
c) 120 d) 180

2) Ester Amylacetate has the flavour of:

(LHR-12-II)

- a) Raspberry b) Apricot  
c) Orange d) Banana

3) Acetic acid is manufactured by: (GRW-15)  
(LHR-2014-II), (MTN-15, 16, 17, 18)

- a) Distillation b) Fermentation  
c) Ozonolysis d) Esterification

4) Which compound is polyprotic acid?

(GRW-2011)

- a)  $CH_3COOH$  b)  $C_6H_5COOH$   
c)  $(COOH)_2$  d)  $C_6H_5OH$

5) Suffix used in the naming of carboxylic acid is: (GRW-2012)

- a) -ene b) -al  
c) -ane d) -oic

6) One of the following organic compound react with Sodium Bicarbonate to produce  $CO_2$  gas: (BWP-2016, 2017)

- $O$   
 $\parallel$
- a)  $CH_3COOH$  b)  $CH_3-C-CH_3$   
c)  $CH_3-CH_2-OH$  d)  $CH_3COOCH_3$

7) Which of the following is the strongest acid: (BWP-2017)

- (a)  $HCOOH$  (b)  $CH_3COOH$   
(c)  $CH_3-CH_2-COOH$   
(d)  $Cl-CH_2-COOH$



- 8) Organic compounds having fruity smell are: (FSD-2014)  
 a) Carboxylic acids b) Alcohols  
 c) Ethers d) Esters
- 9) Which of the following is not a fatty acid? (RWP-2015, 2016), (LHR-12), (SAH-18)  
 a) Propanoic acid b) Acetic acid  
 c) Phthalic acid d) Butanoic acid
- 10) A carboxylic acid contains: (SGD-2013)  
 a) Hydroxyl group  
 b) Carboxyl group  
 c) Aldehydic group  
 d) Ketonic group
- 11) Which reagent is used to reduce a carboxylic acid to an alcohol: (SGD-2015, 2017), (DGK-11, 17), (LHR-2015, 2019), (FSD-15, 16), (GRW-16, 17), (FSD-18)  
 a)  $H_2/Ni$  b)  $H_2/Pt$   
 c)  $NaBH_4$  d)  $LiAlH_4$
- 12) Which of the following esters has orange flavour? (SGD-2017)  
 (a) Amyl acetate (b) Benzyl acetate  
 (c) Amyl butyrate (d) Octyl acetate
- 13) The solution of which acid is used for seasoning of food: (DGK-2017, 18), (BWP-14), (GRW-14), (FSD-15), (LHR-18)  
 (a) Formic acid (b) Acetic acid  
 (c) Benzoic acid (d) Butanoic acid
- 14) Which one is not a fatty acid? (SAH-2017), (SGD-16), (RWP-18)  
 a) Acetic Acid b) Propionic acid  
 c) Butanoic acid d) Palmitic acid
- 15) Which acid is used in the manufacture of synthetic fibre? (AJK-2016), (FSD-13), (MTN-14, 16), (DGK-16), (LHR-17), (GRW-18), (SGD-18)  
 a) Formic acid b) Oxalic acid  
 c) Carbonic acid d) Acetic acid

### III) From Entry Test:-

- (1) Formic acid reduces Tollen's reagent because:  
 (a) It is very strong  
 (b) It is carboxylic acid  
 (c) It has aldehydic group in its structure  
 (d) None of these

- (2) Esterification is faster in case of:  
 (a)  $HCOOH$  (b)  $CH_3COOH$   
 (c)  $(CH_3)_2CHCOOH$  (d) All are equal
- (3) Methyl cyanide on alkaline hydrolysis gives:  
 (a)  $HCOOH$  (b)  $CH_3CONH_2$   
 (c)  $CH_3OH$  (d)  $CH_3COOH$
- (4) When acetamide is treated with dil.  $HCl$  the main product is:  
 (a) Acetic acid (b) Ethyl alcohol  
 (c) Ethyl amine (d) Ethyl cyanide
- (5) Reaction of acetic acid with  $LiAlH_4$  gives:  
 (a) Ethanol (b) Ethane  
 (c) Ethanal (d) Ethyl acetate
- (6) Slight oxidation of primary alcohol gives:  
 (a) Ketone (b) Organic acid  
 (c) Aldehyde (d) An ester
- (7) Which of the following is the strongest acid?  
 (a)  $HCOOH$  (b)  $CH_3COOH$   
 (c)  $CH_3-CH_2-COOH$   
 (d)  $Cl-CH_2-COOH$
- (8) Which of the following esters shows the flavour of orange:  
 (a) Benzyl acetate (b) Iso-butyl formate  
 (c) Octyl acetate (d) Ethyl butyrate
- (9) Which acid is used in the manufacture of synthetic fibre?  
 (a) Formic acid (b) Acetic acid  
 (c) Carbonic acid (d) Benzoic acid

## SECTION II

### SHORT QUESTIONS

#### b) From Exercise:-

#### QUESTIONS

1. Write down the structural formulae of the following:  
 (i) Valeric acid (ii) Propionic acid  
 (iii) Oxalic acid (iv) Benzoic acid  
 (v) Acetic anhydride  
 (vi) Acetyl chloride
2. Write down the names of the following compounds by IUPAC system:
- (i)

$$\begin{array}{c} \text{COOH} \\ | \\ \text{CH}_3 \\ | \\ \text{COOH} \\ || \\ \text{O} \end{array}$$

(iii)  $H-C-OH$

(ii)

$$\begin{array}{c} \text{COOH} \\ | \\ \text{C}_6\text{H}_5 \\ || \\ \text{O} \\ | \\ \text{CH}_3-C-K_2H_6 \end{array}$$

(iv)



- i. Acetyl chloride ii. Acetamide
10. Write down the mechanism of reaction between acetic acid and thionyl chloride. (GRW-2013)
11. How would you prepare carboxylic acid from primary alcohols and aldehydes? (GRW-2014)
12. Write down reactions of acetic acid with  $\text{Na}_2\text{CO}_3$ ,  $\text{PCl}_5$ ,  $\text{C}_2\text{H}_5\text{OH}$ ,  $\text{NH}_3$ . (MTN-2013, 13)
13. Write down any four methods of preparation of acetic acid with reactions. (BWP-2014)  
(DGK-13)
14. Write the reactions of acetic acid with following (BWP-2013)
- (i)  $\text{NaOH}$  (ii)  $\text{Na}_2\text{CO}_3$   
(iii)  $\text{NaHCO}_3$  (iv)  $\text{Na}$
15. Discuss the mechanism of esterification between a carboxylic acid and an alcohol. (FSD-2013)
16. What is glacial acetic acid? Write down any three methods to prepare acetic acid. (RWP-2014)
17. How acetic acid reacts with ammonia? Give its mechanism. (SGD-2013)
18. Convert acetic acid into acetyl chloride, ethanamide and ethyl alcohol. (DGK-2012)
19. Write down the mechanism of the reaction between acetic acid and ethanol. (SAH-2014)  
(GRW-11)



## Chapter — 14

# MACROMOLECULES

## Chapter Excluded





## Chapter — 15

## (II) From Punjab Boards:

COMMON CHEMICAL  
INDUSTRIES IN PAKISTAN

## SECTION I

## Multiple Choice Questions

## Exercise:

Which three elements are needed for the healthy growth of plants?

- (a) N, S, P (b) N, Ca, P  
(c) N, P, K (d) N, K, C

The nitrogen present in some fertilizers helps plants

- (a) to fight against diseases  
(b) to produce fat  
(c) to undergo photosynthesis  
(d) to produce protein

Phosphorus helps in the growth of

- (a) root (b) leave  
(c) stem (d) seed

Micro-nutrients are required in quantity ranging from

- (a) 4-40g (b) 6-200g  
(c) 6-200kg (d) 4-40kg

During the manufacturing process of cement the temperature of the decomposition zone goes up to

- (a) 600°C (b) 800°C  
(c) 1000°C (d) 1200°C

Which is not a calcareous material?

- (a) Lime (b) clay  
(c) marble (d) marine shell

How many zones through which the charge passes in a rotary kiln?

- (a) 4 (b) 3  
(c) 2 (d) 5

Ammonium nitrate fertilizer is not used for which crop.

- (a) Cotton (b) Wheat  
(c) Sugar cane (d) Paddy rice

1) The nitrogenous fertilizer easily taken up by plants is: (LHR-2011)

- a) Urea b) Ammonium nitrate  
c) Ammonia gas d) Ammonia liquid

2) Percentage of nitrogen in urea is:

(LHR-2012-II)

- a) 76% b) 56%  
c) 46% d) 86%

3) Cement contains gypsum: (LHR-2012-II)

- a) 3% b) 2%  
c) 0.2% d) 0.3%

4) The three elements needed for the healthy growth of plants are: (GRW-2010, 15, 18),

(RWP-16), (MTN-16),

(SGD-17, 18, 19), (FSD-18)

- a) N, S, P b) N, Ca, P  
c) N, P, K d) N, K, C

5) Ammonium nitrate fertilizer is not used for which crop? (GRW-2017), (BWP-14, 15),

(RWP-15), (LHR-15, 18), (SAH-18)

- a) Cotton b) Wheat  
c) Sugarcane d) Paddy rice

6) Macronutrient for soil is: (FSD-2014)

- a)  $N_2$  b) Cu  
c) Zn d) Fe

7) Phosphorus helps in the growth of:

(RWP-2017), (MTN-14, 17),

(DGK-15, 16, 19), (GRW-15),

(FSD-15), (LHR-17), (MTN-18)

- a) Root b) Leaves  
c) Seed d) Stem

8) Zones through which the charge passes in rotary kiln. (DGK-2011, 18), (LHR-14)

- a) 5 b) 4  
c) 3 d) 2



- 9) Micronutrients are required in quantity ranging from: (DGK-2017), (FSD-13), (BWP-16)
- a) 4 – 40g      b) 6 – 20g  
c) 6 – 200g      d) 4 – 40kg

- 10) Which is not a calcareous material? (SAH-2017-II), (GRW-11), (DGK-12, 13, 18), (LHR-14, 15), (MTN-15), (BWP-17, 18), (RWP-18)
- a) Lime      b) Clay  
c) Marble      d) Marine shell

- 11) The nitrogen present in some fertilizers helps plants: (AJK-2016), (FSD-17)
- a) to fight against diseases  
b) To produce fat  
c) To undergo photosynthesis  
d) To produce protein

### III) From Entry Test:-

- (1) Nitrogen helps in:
- a) Normal growth of plant  
b) Protein synthesis  
c) Nucleic acid synthesis  
d) All of above
- (2) The nutrients which are required in very small amount for growth of plants are called:
- a) Nitrogenous fertilizers  
b) Micronutrients  
c) Macronutrients      d) Surfactants
- (3) Which of the following element is not macro-nutrient?
- a) B      b) N  
c) P      d) K
- (4) Which of the following is not micro-nutrient?
- a) Fe      b) Mn  
c) Cu      d) H

- (5) Which of the following is not calcareous material?
- a) Lime stone      b) Marine shell  
c) Clay      d) Marble
- (6) Which is not argillaceous material?
- a) Lime stone      b) Clay  
c) Slate      d) None
- (7) The %age of nitrogen in  $\text{NH}_4\text{NO}_3$  is:
- a) 33 – 33.5%      b) 30 – 33.5%  
c) 30 – 32.5%      d) 31 – 32%
- (8) What is the main function of rotary kiln?
- a) Heating lime stone  
b) Heating of clinker  
c) Drying of slurry  
d) Preparation of clinker
- (9) Which of the following process is alkaline?
- a) Kraft process  
b) Sulphite process  
c) Neutral sulphite semi chemical process (NSSC)  
d) None
- (10) DAP contains  $\text{P}_2\text{O}_5$ :
- a) 48%      b) 38%  
c) 68%      d) 75%
- (11) Which of the following compounds is present in highest percentage in cement?
- a) Lime      b) Clay  
c)  $\text{Na}_2\text{O}$       d) Alumina
- (12) Which fertilizer is widely used in Pakistan?
- a) Urea      b)  $\text{KNO}_3$   
c) DAP      d)  $\text{K}_2\text{SO}_4$
- (13) Which of the following fertilizers, contains 75% nutrient?
- a) DAP      b) TAP  
c) Urea      d)  $\text{NH}_4\text{NO}_3$



1A

## FUNDAMENTAL CONCEPTS

## Multiple Choice Questions

## Entry Test Questions:

- How many 'Cl' (chlorine) atoms are in two moles of chlorine? (2011)
  - $2 \times 6.02 \times 10^{23}$  atoms
  - $35.5 \times 6.02 \times 10^{23}$  atoms
  - $2 \times 10^{23}$  atoms
  - $2 \times 6.02 \times 10^{23}$  atoms
- When 8 grams (4 moles) of  $H_2$  react with 2 moles of  $O_2$ , how many moles of water will be formed? (2012)
  - Five
  - Four
  - Six
  - Three
- Hydrogen burns in chlorine to produce hydrogen chloride. The ratio of masses of reactants in chemical reaction is: (2013)
 
$$H_2 + Cl_2 \rightarrow 2HCl$$
  - 1:35.5
  - 2:35.5
  - 1:71
  - 2:70
- The number of molecules in 9 g of ice ( $H_2O$ ) is (2014)
  - $6.02 \times 10^{24}$
  - $6.02 \times 10^{23}$
  - $3.01 \times 10^{24}$
  - $3.01 \times 10^{23}$
- How many moles of sodium are present in 0.1 g of sodium? (2015)
  - $4.3 \times 10^{-3}$
  - $4.03 \times 10^{-1}$
  - $4.01 \times 10^{-2}$
  - $4.3 \times 10^{-2}$

Answers:

1.	d	2.	b	3.	a	4.	d	5.	a
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★ ★ ★

2A

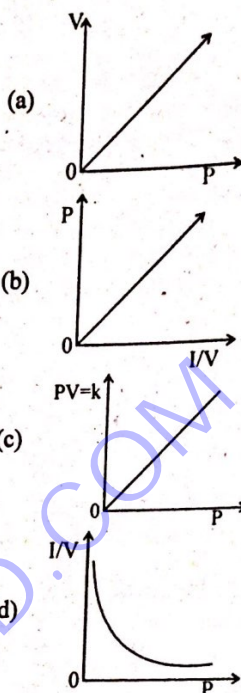
## STATES OF MATTER

## Multiple Choice Questions

## Entry Test Questions:

- Melting point of water is higher than petrol, because intermolecular forces in water are: (2011)
  - Weaker than petrol
  - Stronger than petrol
  - Same as in petrol
  - Negligible
- Ice is less dense than water at: (2014)
  - $0^\circ C$
  - $4^\circ C$
  - $-4^\circ C$
  - $2^\circ C$

3. Which graph represents Boyle's law?



- London dispersion forces are the forces present among the: (2011)
  - Molecules of  $H_2O$  in liquid state
  - Molecules of  $HCl$  gas
  - Atoms of helium in gaseous state at high temperature
  - Molecules of solid chlorine

Answers:

1.	a	2.	a	3.	d	4.	c
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★ ★ ★

3A

## ATOMIC STRUCTURE

## Multiple Choice Questions

## Entry Test Questions:

- The elements for which the value of ionization energy is low, can: (2011)
  - Gain electrons readily
  - Gains electron with difficulty
  - Loss electrons less readily
  - Lose electrons readily



The nature of cathode rays in discharge tube: (2011)

- Depends on the nature of gas taken in the discharge tube
- Depends upon the nature of cathode in discharge tube
- Is independent of the nature of the gas in discharge tube
- Depends upon the nature of anode in the discharge tube

The relative energies of 4s, 4p and 3d orbitals are in the order (2012)

- $3d < 4p < 4s$
- $4s < 3d < 4p$
- $4p < 4s < 3d$
- $4p < 3d < 4s$

Number of electrons in the outermost shell of chloride ion ( $\text{Cl}^-$ ) is: (2013)

- 17
- 3
- 1
- 8

According to the number of protons, neutrons and electrons given in the table, which one of the following options is correct? (2014)

Species	Proton	Neutron	Electron
As	33	42	30
Ga	31	39	28
Ca	20	20	20

- $\text{As}^{+3}, \text{Ga}^{+3}, \text{Ca}$
- $\text{As}^{+1}, \text{Ga}^{+2}, \text{Ca}$
- $\text{As}^{+3}, \text{Ga}^{+3}, \text{Ca}^{+2}$
- $\text{As}^{+1}, \text{Ga}, \text{Ca}^{+2}$

If the e/m value of electron is  $1.7588 \times 10^{11}$  coulombs  $\text{Kg}^{-1}$ , then what would be the mass of electron in grams (charge on electron is  $1.6022 \times 10^{-19}$  coulombs)? (2014)

- $9.1095 \times 10^{-31} \text{ g}$
- $91.095 \times 10^{-31} \text{ g}$
- $9.1095 \times 10^{-28} \text{ g}$
- $0.919095 \times 10^{-33} \text{ g}$

The maximum number of electrons in electronic configuration can be calculated by using formula: (2016)

- $2l + 1$
- $2n^2 + 2$
- $2n^2$
- $2n^2 + 1$

4A

## CHEMICAL BONDING

### Multiple Choice Questions

#### Entry Test Questions:

- The ability of an atom in a covalent bond to attract the bonding electrons is called: (2011)
  - Ionization energy
  - Ionic bond energy
  - Electronegativity
  - Electron affinity
- The paramagnetic character of a substance is due to: (2011)
  - Bond pairs of electrons
  - Lone pairs of electrons
  - Unpaired electrons in atom or molecule
  - Paired electrons in valence shells of electrons
- The angle between unhybridized p-orbital and three  $sp^2$  hybrid orbitals of each carbon atom in ether is: (2012)
  - $120^\circ$
  - $90^\circ$
  - $109.5^\circ$
  - $180^\circ$
- In 'H-F' bond electronegativity difference is '1.9'. What is the type of this bond? (2012)
  - Polar covalent bond
  - Non-polar covalent bond
  - Pi ( $\pi$ ) bond
  - Co-ordinate covalent bond
- According to valence shell electron pair repulsion theory, the repulsive forces between the electron pair of central atom of molecule are in the order: (2013)
  - Lone Pair - Lone Pair > Lone Pair - Bond Pair > Bond Pair - Bond Pair
  - Lone Pair - Bond Pair > Lone Pair - Lone Pair > Bond Pair - Bond Pair
  - Bond Pair - Bond Pair > Lone Pair - Lone Pair > Lone Pair - Bond Pair
  - One Pair - Bond Pair > Bond Pair - Bond Pair > Lone Pair - Lone Pair
- In crystal lattice of ice, each O-atom of water molecule is attached to: (2013)
  - Four H-atoms
  - Three H-atoms
  - One H-atom
  - Two H-atoms

Answers:

1.	d	2.	c	3.	b	4.	d
5.	a	6.	c	7.	c		

—★—★—★—



7. The suitable representation of dot structure of chlorine molecule is: (2014)

- (a)  $\text{:}\ddot{\text{Cl}}\text{:}$  (b)  $\ddot{\text{Cl}}\|\ddot{\text{Cl}}$   
(c)  $\text{:}\ddot{\text{Cl}}\text{:}\ddot{\text{Cl}}\text{:}$  (d)  $\ddot{\text{Cl}}\text{:}\ddot{\text{Cl}}$

8. When the two partially filled atomic orbitals overlap in such a way that the probability of finding electron is maximum around the line joining the two nuclei, the result is the formation of: (2014)

- (a) Sigma Bond (b) Pi-Bond  
(c) Hydrogen Bond (d) Metallic Bond

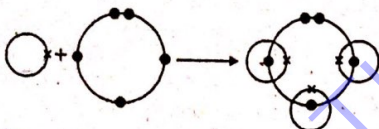
9. Which one of the following hydrogen bonds is stronger than others? (2015)

- (a)  $\text{N}^{\delta-}-\text{H}^{\delta+} \cdots \cdots \text{N}^{\delta-}-\text{H}^{\delta+}$   
(b)  $\text{F}^{\delta-}-\text{H}^{\delta+} \cdots \cdots \text{F}^{\delta-}-\text{H}^{\delta+}$   
(c)  $\text{O}^{\delta-}-\text{H}^{\delta+} \cdots \cdots \text{O}^{\delta-}-\text{H}^{\delta+}$   
(d)  $\text{N}^{\delta-}-\text{H}^{\delta+} \cdots \cdots \text{O}^{\delta-}-\text{H}^{\delta+}$

10. Which of the following is the correct dot and cross diagram of bonding between two chlorine atoms? (2015)

- (a)  $\text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:} \rightarrow \text{:}\ddot{\text{Cl}}\text{:}$   
(b)  $\text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:} \rightarrow \text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:}$   
(c)  $\text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:} \rightarrow \text{:}\ddot{\text{Cl}}\text{:} \text{ } \text{:}\ddot{\text{Cl}}\text{:}$   
(d)  $\text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:} \rightarrow \text{:}\ddot{\text{Cl}}\text{:} + \text{:}\ddot{\text{Cl}}\text{:}$

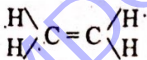
11.



Choose the right molecule. (2016)

- (a)  $\text{CH}_3$  (b)  $\text{CO}$   
(c)  $\text{H}_2\text{O}$  (d)  $\text{NH}_3$

2.



Calculate the number of  $\sigma$  bonds and  $\pi$  bonds in the molecule. (2016)

- (a)  $1\pi$  and  $5\sigma$  bonds (b)  $2\pi$  and  $4\sigma$  bonds  
(c)  $3\pi$  and  $3\sigma$  bonds (d)  $6\pi$  and  $6\sigma$  bonds

Answers:

1.	c	2.	c	3.	b	4.	a
5.	a	6.	a	7.	b	8.	a
9.	b	10.	c	11.	d	12.	a

—★—★—★—

5A

## CHEMICAL ENERGETICS

### Multiple Choice Questions

#### Entry Test Questions:

- Lattice energy of an ionic crystal is the enthalpy of: (2011)  
(a) Combustion (b) Dissociation  
(c) Dissolution (d) Formation
- In standard enthalpy of atomization, heat of the surrounding: (2011)  
(a) Remains unchanged  
(b) Increases  
(c) Increases than decreases  
(d) Decreases
- ' $\Delta H$ ' will be given a negative sign in: (2012)  
(a) Exothermic reactions  
(b) Decomposition reactions  
(c) Dissociation reaction  
(d) Endothermic reactions
- Lattice energy of an ionic crystal is the enthalpy of: (2012)  
(a) Combustion (b) Dissociation  
(c) Dissolution (d) Formation
- Heat of formation ( $\Delta H_f^\circ$ ) for  $\text{CO}_2$  is: (2013)  
(a)  $-394 \text{ kJ/mole}$  (b)  $+394 \text{ kJ/mole}$   
(c)  $-294 \text{ kJ/mole}$  (d)  $-390 \text{ kJ/mole}$
- $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} \quad \Delta H = -285.5 \text{ kJ mol}^{-1}$   
What will be the enthalpy change in the above reaction? (2014)  
(a)  $205.5 \text{ kJ/mol}$  (b) Zero  $\text{kJ/mol}$   
(c)  $-205.5 \text{ kJ/mol}$  (d)  $1 \text{ kJ/mol}$
- Combustion of graphite to form  $\text{CO}_2$  can be done by two ways. Reactions are given as follows: (2014)  
 $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 \quad \Delta H = -393.7 \text{ kJ mol}^{-1}$   
 $\text{C} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO} \quad \Delta H = ?$   
 $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2 \quad \Delta H = -283 \text{ kJ mol}^{-1}$   
What will be enthalpy of formation of  $\text{CO}$ ?  
(a)  $-676 \text{ kJ mol}^{-1}$  (b)  $-110 \text{ kJ mol}^{-1}$   
(c)  $110 \text{ kJ mol}^{-1}$  (d)  $676 \text{ kJ mol}^{-1}$



8. The equation that represents standard enthalpy of atomization of hydrogen is:

(2015)

- (a)  $\frac{1}{2} \text{H}_2\text{O}(l) \rightarrow \text{H}_{2(g)} + \frac{1}{2} \text{O}_{(g)} + 218 \text{ kJ mol}^{-1}$   
 (b)  $\frac{1}{2} \text{H}_2\text{O}(l) \rightarrow \text{H}_{2(g)} + \frac{1}{2} \text{O}_{(g)} - 218 \text{ kJ mol}^{-1}$   
 (c)  $\frac{1}{2} \text{H}_{2(g)} \rightarrow \text{H}_{(g)} + 218 \text{ kJ mol}^{-1}$   
 (d)  $\frac{1}{2} \text{H}_{2(g)} \rightarrow \text{H}_{(g)} - 218 \text{ kJ mol}^{-1}$

9. Standard enthalpy of combustion of graphite at 25 °C is  $-393.51 \text{ kJ mol}^{-1}$  and that of diamond is  $-395.41 \text{ kJ mol}^{-1}$ . The enthalpy change for graphite is:

(2015)

- (a)  $-1.91$  (b)  $+2.1$   
 (c)  $-2.1$  (d)  $+1.91$

10.  $\frac{1}{2} \text{H}_{2(g)} \rightarrow \text{H}_{(g)} \quad \Delta H = 218 \text{ kJ mol}^{-1}$

In this reaction,  $\Delta H$  will be called: (2016)

- (a) Enthalpy of atomization  
 (b) Enthalpy of decomposition  
 (c) Enthalpy of formation  
 (d) Enthalpy of the dissociation

11.  $\text{Mg} + \frac{1}{2} \text{O}_{2(g)} \rightarrow \text{MgO}_{(g)} + -692 \text{ kJ mol}^{-1}$  at

STP. (2016)

Enthalpy of the above reaction will be called:

- (a)  $\Delta H^\circ_{\text{at}}$  (b)  $\Delta H^\circ_{\text{s}}$   
 (c)  $\Delta H^\circ_{\text{sol}}$  (d)  $\Delta H^\circ_{\text{f}}$

Answers:

1. d	2. d	3. a	4. d
5. a	6. c	7. b	8. c
9. d	10. a	11. d	

6A

## SOLUTIONS

### Multiple Choice Questions

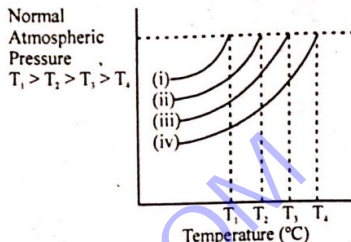
#### Entry Test Questions:

1. As number of solute particles increases, freezing point of the solution: (2012)  
 (a) Remains the same (b) Increases  
 (c) First increases, then decreases  
 (d) Decreases

2. If 18.0 g of glucose is dissolved in 1 kg of water, boiling point of this solution should be: (2013)

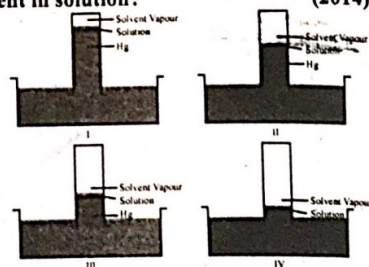
- (a)  $100.52^\circ\text{C}$  (b)  $100.00^\circ\text{C}$   
 (c)  $100.052^\circ\text{C}$  (d) Less than  $100^\circ\text{C}$

3. The vapor pressure lines for pure as well as solutions of different concentrations are shown. Which line represents pure water? (2014)



- (a) (i) (b) (ii)  
 (c) (iii) (d) (iv)

4. One mole of glucose was dissolved in 1 kg of water, ethanol, ether and benzene separately and the molal boiling point constant of each individual solution was found to be 0.52, 1.75, 2.16 and 2.70 in the units of  $^\circ\text{C kg mol}^{-1}$  respectively. Which of the following figures shows benzene as solvent in solution? (2014)



- (a) I (b) II  
 (c) III (d) IV

5. Freezing point will also be defined as that temperature at which its solid and liquid phases have the same: (2016)

- (a) Concentration  
 (b) Ratio between the particles  
 (c) Vapour pressure  
 (d) Attraction between the phases

Answers:

1. d	2. c	3. a	4. a
5. c			



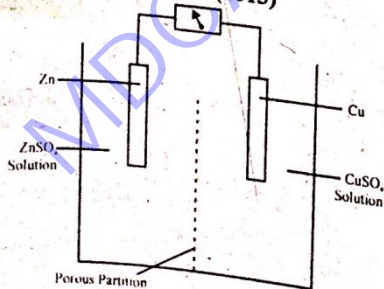
7A

## ELECTROCHEMISTRY

## Multiple Choice Questions

## Entry Test Questions:

- In electrolytic cell, a salt bridge is used in order to: (2011)
  - Pass the electric current
  - Prevent the flow of ions
  - Mix solution of two half cells
  - Allow movement of ions b/w two half cells
- In all oxidation reactions, atoms of an element in a chemical species lose electrons and increase their: (2011)
  - Oxidation states
  - Reductions
  - Electrode
  - Negative charges
- In electrolysis of aqueous  $\text{CuCl}_2$ , the metal deposited at cathode is (2012)
  - Sodium
  - Aluminium
  - Lead
  - Copper
- In  $\text{MgCl}_2$ , the oxidation state of 'Cl' is: (2012)
  - Zero
  - +2
  - 2
  - 1
- In the figure given below, the electron flow in external circuit is from: (2013)



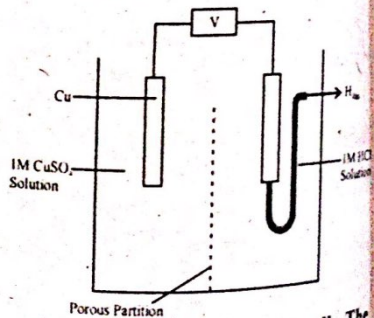
- Copper to zinc electrode
- Right to left
- Porous partition to zinc electrode
- Zinc to copper electrode

- Which one of the following is a redox reaction?
  - $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgCl}$
  - $2\text{Cl} \rightarrow \text{Cl}_2 + 2\text{e}^-$
  - $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
  - $\text{Na}^+ + 1\text{e}^- \rightarrow \text{Na}$
- In  $\text{SO}_4^{2-}$  the oxidation number of S is: (2014)
  - 8
  - +8
  - 6
  - +6
- Coinage metals Cu, Ag, and Au are least reactive because they have:
  - Negative reduction potential
  - Positive reduction potential
  - Negative oxidation potential
  - Positive oxidation potential
- Positive oxidation potential
 

$\text{Zn} \rightarrow \text{Zn}^{+2} + 2\text{e}^- \quad E^\circ = +0.76\text{V}$

$\text{Cu} \rightarrow \text{Cu}^{+2} + 2\text{e}^- \quad E^\circ = -0.34\text{V}$

  - $\text{Cu} + \text{Zn}^{+2} \rightarrow \text{Cu}^{+2} + \text{Zn}$
  - $\text{Cu}^{+2} + \text{Zn}^{+2} \rightarrow \text{Cu} + \text{Zn}$
  - $\text{Cu}^{+2} + \text{Zn} \rightarrow \text{Cu} + \text{Zn}^{+2}$
  - $\text{Cu}^{+2} + \text{Zn}^{+2} \rightarrow \text{Cu} + \text{Zn}^{+2}$
- Keeping in mind the electrode potentials, which one of the following reactions is feasible? (2012)
  - $\text{Zn}^{+2} + \text{Cu} \rightarrow \text{Cu}^{+2} + \text{Zn}$
  - $\text{Zn} + \text{MgSO}_4 \rightarrow \text{ZnSO}_4 + \text{Mg}$
  - $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
  - $\text{Cd} + \text{MgSO}_4 \rightarrow \text{CdSO}_4 + \text{Mg}$



- The diagram shows a galvanic cell. The current will flow from: (2016)
  - Hydrogen electrode to copper electrode
  - Copper electrode to hydrogen electrode
  - Hydrogen electrode to HCl solution
  - $\text{CuSO}_4$  solution to hydrogen electrode



## Answers:

1. d	2. a	3. d	4. d
5. d	6. c	7. d	8. b
9. c	10. c	11. a	

—★—★—★—

8A

## CHEMICAL EQUILIBRIUM

## Multiple Choice Questions

## Entry Test Questions:

1. In 'AgCl' solution. Some salt of NaCl is added, 'AgCl' will be precipitated due to:

(2011)

- (a) Solubility (b) Electrolyte  
(c) Unsaturation effect  
(d) Common ion effect

2. 'Ka' for an acid is higher, the stronger is the acid; relate the strength an acid with 'pKa'

(2011)

- (a) Higher pKa, weaker the acid  
(b) Lower pKa, stronger the acid  
(c) pKa has no relation with acid strength  
(d) Both A and B

3. Formation of  $\text{NH}_3$  is reversible and exothermic process, what will happen on cooling?

(2012)

- (a) More reactant will form  
(b) More  $\text{N}_2$  will be formed  
(c) More  $\text{H}_2$  will be formed  
(d) More product ( $\text{NH}_3$ ) will be formed

4. A buffer solution is that which resists/minimizes the change in:

(2012)

- (a) pOH (b) pH  
(c) pKa (d) pKb

5. The chemical substance, when dissolved in water, gives " $\text{H}^+$ " is called:

(2013)

- (a) Acid (b) Base  
(c) Amphoteric (d) Neutral

6. The 'pH' of our blood is:

(2013)

- (a) 6.7 - 8 (b) 7.9  
(c) 7.5 (d) 7.35 - 7.4

7. The value of equilibrium constant ( $K_c$ ) for the reaction  $2\text{HF}_{(g)} \rightleftharpoons \text{H}_{2(g)} + \text{F}_{2(g)}$  is  $10^{-13}$  at  $2000^\circ\text{C}$ . Calculate the value of  $K_p$  for this reaction: (2014)

- (a)  $2 \times 10^{-13}$  (b)  $10^{-13}$   
(c)  $186 \times 10^{-13}$  (d)  $3.48 \times 10^{-9}$

8. What will be the pH of a solution of NaOH with a concentration of  $10^{-3}\text{M}$ ? (2014)

- (a) 3 (b) 14 (c) 11 (d) 7

9. What is the correct relation between pH and pK?

(2015)

(a)  $\text{pH} = \text{pKa} + \log \left[ \frac{\text{Acid}}{\text{Base}} \right]$

(b)  $\text{pH} = \text{pKa} - \log \left[ \frac{\text{Acid}}{\text{Base}} \right]$

(c)  $\text{pH} = \text{pKa} - \log \left[ \frac{\text{Base}}{\text{Acid}} \right]$

(d)  $\text{pH} = \text{pKa} + \log \left[ \frac{\text{Base}}{\text{Acid}} \right]$

10. Human blood maintains its pH between:

- (a) 6.50 - 7.00 (b) 7.20 - 7.25  
(c) 7.50 - 7.55 (d) 7.35 - 7.40

## Answers:

1. d	2. d	3. d	4. b
5. a	6. d	7. b	8. c
9. b, d	10. d		

—★—★—★—

9A

## REACTION KINETICS

## Multiple Choice Questions

## Entry Test Questions:

1. According to collision theory of bimolecular reaction in gas phase, the minimum amount of energy required for an effective collision is known as: (2011)

- (a) Heat of reaction  
(b) Rate of reaction  
(c) Has no effect on the reaction  
(d) Energy of activation

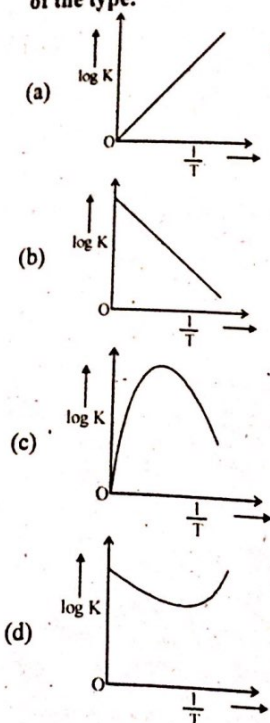
2. The reaction rate in forward direction decreases with the passage of time because:

(2012)

- (a) Concentration of reactants decrease  
(b) Concentration of product decreases  
(c) The order of reaction changes  
(d) Temperature of the system changes



3. By considering Arrhenius equation, the graph between  $\frac{1}{T}$  and 'log K' given a curve of the type: (2013)



4. In zero order reactions, the rate is independent of: (2013)

- (a) Concentration of the product  
(b) Concentration of the reactant  
(c) Temperature of the reaction  
(d) Surface area of the product

5. For the reaction  $2\text{NO} + \text{O}_2 \rightleftharpoons 2\text{NO}_2$ , the rate equation for the forward reaction is: (2014)

- (a)  $\text{Rate} = k [\text{NO}] [\text{O}_2]$   
(b)  $\text{Rate} = k [\text{NO}]^2 [\text{O}_2]$   
(c)  $\text{Rate} = k [\text{NO}_2]^2$   
(d)  $\text{Rate} = k [\text{NO}_2]$

6. The half-life of  $\text{N}_2\text{O}_5$  at 0 °C is 24 minutes. How long will it take for sample of  $\text{N}_2\text{O}_5$  to decay to 25% of its original concentration? (2015)

- (a) 24 minutes (b) 72 minutes  
(c) 120 minutes (d) 48 minutes

7. When the change in concentration is  $6 \times 10^{-3} \text{ mol dm}^{-3}$  and time for that change is 2 seconds, the rate of reaction will be:

- (a)  $6 \times 10^{-3} \text{ mol dm}^{-3} \text{ sec}^{-1}$   
(b)  $6 \times 10^{-4} \text{ mol dm}^{-3} \text{ sec}^{-1}$   
(c)  $6 \times 10^{-2} \text{ mol dm}^{-3} \text{ sec}^{-1}$   
(d)  $6 \times 10^{-5} \text{ mol dm}^{-3} \text{ sec}^{-1}$

8.  $2\text{A} + \text{B} \rightarrow \text{Product}$

If the reactant 'B' is in excess, the order of reaction with respect to 'A' in given law,  $\text{Rate} = k [\text{A}]^2 [\text{B}]$  is:

- (a) 2nd order reaction  
(b) 1st order reaction  
(c) Pseudo 1st order reaction  
(d) 3rd order reaction

9. The rate constant 'k' is  $0.693 \text{ min}^{-1}$ . The half-life for the 1st order reaction will be:

- (a) 1 min (b) 2 min  
(c) 0.693 min (d) 4 min

Answers:

1.	d	2.	a	3.	b	4.	b
5.	b	6.	d	7.	d	8.	a
9.	a						

1B

## PERIODS

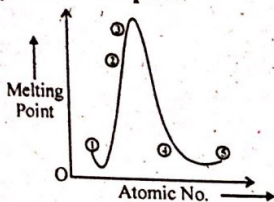
### Multiple Choice Questions

#### Entry Test Questions:

1. Carbon exists as allotropes, which are different crystalline or molecular forms of the same substance. Graphite and diamond are allotropes of carbon. Diamond is a non-conductor whereas graphite is a good conductor because: (2015)
- (a) Graphite has a layered structure  
(b) In graphite, all valence electrons are tetrahedrally bound  
(c) In graphite one of valence electrons is free to move  
(d) Graphite is soft and greasy



The diagram below is a plot of melting points of elements of second period against their atomic numbers. Lithium and fluorine are placed at the extreme ends of the plot, on the basis of melting points where will you place Carbon among the empty slots on the plot? (2011)



- (a) 1 (b) 2  
(c) 4 (d) 3

Which one remains same along a period? (2012)

- (a) Atomic radius  
(b) Melting point  
(c) Number of shells (orbits)  
(d) Electrical conductivity

More the ionization energy of an element: (2012)

- (a) More the electropositivity  
(b) More the reducing power  
(c) Less the metallic character  
(d) Bigger the atomic radius

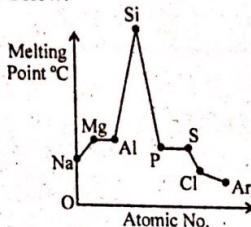
What is the trend of melting and boiling point of the elements of short periods as we move from left to right in a periodic table? (2013)

- (a) Melting and boiling points first decrease then increase  
(b) Melting and boiling points increase gradually  
(c) Melting and boiling points first increase then decrease  
(d) Melting and boiling points decrease gradually

Along a period, atomic radius decreases. This gradual decrease in radius is due to: (2013)

- (a) Increase in number of electrons in valence shells  
(b) Increase in number of protons in the nucleus  
(c) Decrease in number of shells  
(d) Increase in number of shells

7. The trends, in melting points of the elements of 3rd period, are depicted in figure below. (2014)



The sharp decrease observed from 'Si' to 'P' is due to

- (a) Decrease in atomic radius from 'Si' to 'P'  
(b) Change in bonding and structure of two elements  
(c) Different universities of two elements  
(d) Increase in electron density from 'Si' to 'P'

8. Arrange the following elements according to the trend of ionization energies. (C, N, Ne, B) (2014)

- (a)  $\text{Ne} < \text{N} < \text{C} < \text{B}$  (b)  $\text{B} < \text{N} < \text{C} < \text{Na}$   
(c)  $\text{B} < \text{C} < \text{N} < \text{Na}$  (d)  $\text{Ne} < \text{B} < \text{C} < \text{N}$

9. Which one of the following will have the smallest radius? (2015)

- (a)  $\text{Al}^{3+}$  (b)  $\text{Si}^{4+}$   
(c)  $\text{Mg}^{2+}$  (d)  $\text{Na}^{+}$

10. Keeping in view the size of atoms, which order is correct? (2015)

- (a)  $\text{N} > \text{C}$  (b)  $\text{P} > \text{Si}$   
(c)  $\text{Ar} > \text{Cl}$  (d)  $\text{Li} > \text{Be}$

11. Melting points of group II-A elements are higher than those of group I-A because: (2016)

- (a) Atoms of II-A elements have smaller size  
(b) II-A elements are more reactive  
(c) Atoms of II-A elements provide two binding electrons  
(d) I-A elements have smaller atomic radius

12. The ionic radius of fluoride ion is: (2016)

- (a) 72 pm (b) 95 pm  
(c) 136 pm (d) 157 pm

Answers:

1.	c	2.	d	3.	c	4.	c
5.	c	6.	d	7.	b	8.	c
9.	b	10.	d	11.	c	12.	c

—★—★—★—



2B

## GROUPS

## Multiple Choice Questions

## Entry Test Questions:

- When elements of group II-A (alkaline earth metals) are exposed to air, they quickly become coated with a layer of oxide. What is the purpose of this oxide layer? (2011)
  - The oxide layer exposes the metal to Atmospheric attack
  - The oxide layer increases the reactivity of metal
  - The oxide layer protects the metal from further atmospheric attack
  - The oxide layer gives the metal a shiny silvery appearance
- In silicon dioxide each silicon atom is tetrahedrally bonded to four oxygen atoms and each oxygen atom is bonded to two silicon atoms. The ratio of silicon to oxygen atoms is: (2011)
  - 2:2
  - 1:2
  - 2:1
  - 1:4
- Carbon has the unique ability to form long chains by bonding with other carbon atoms. This property of self-linking in carbon is known as: (2012)
  - Condensation
  - Polymerization
  - Cyclization
  - Catenation
- Alkaline earth metal oxides react with water to give hydroxides. The solubility of alkaline earth metal oxides in water increases as we move from top to bottom in a group. Which of the following alkaline earth metal oxides is least soluble in water? (2013)
  - MgO
  - CaO
  - BaO
  - SrO
- On the basis of oxidizing power of halogens, which reaction is possible? (2015)
  - $I_2 + 2Cl^- \longrightarrow Cl_2 + 2I^-$
  - $Br_2 + 2I^- \longrightarrow I_2 + 2Br^-$
  - $Cl_2 + 2F^- \longrightarrow F_2 + 2Cl^-$
  - $I_2 + 2Br^- \longrightarrow Br_2 + 2I^-$

- $2NaOH(aq) + Cl_2(g) \longrightarrow NaCl + NaOCl$   
H<sub>2</sub>O proceed at: (201)
  - 500 °C
  - 200 °C
  - 10 °C
  - 15 °C
- Which halogen molecule 'X<sub>2</sub>' has the highest dissociation energy? (201)
  - Cl<sub>2</sub>
  - Br<sub>2</sub>
  - I<sub>2</sub>
  - F<sub>2</sub>

## Answers:

1.	c	2.	b	3.	d	4.	
5.	B	6.	d	7.	d		

3B

## TRANSITION ELEMENTS

## Multiple Choice Questions

## Entry Test Questions:

- Hydrogenation of unsaturated oils is done by using: (2011)
  - Finally divided nickel
  - Finally divided iron
  - Vanadium pentaoxide
  - Copper
- Oxidation state of 'Mn' in KMnO<sub>4</sub>, MnO<sub>2</sub> and MnSO<sub>4</sub> is in the order:
  - +7, +6, +2, +4
  - +6, +7, +2, +4
  - +7, +6, +4, +2
  - +4, +6, +7, +2
- Which one pair has the same oxidation state of 'Fe'? (2013)
  - FeSO<sub>4</sub> and FeCl<sub>3</sub>
  - FeCl<sub>2</sub> and FeCl<sub>3</sub>
  - FeSO<sub>4</sub> and FeCl<sub>2</sub>
  - Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> and FeSO<sub>4</sub>
- [Ti(HO)<sub>6</sub>]<sup>3+</sup> transmits: (2015)
  - Yellow and Red light
  - Yellow and Blue light
  - Red and white light
  - Red and blue light

## Answers:

1.	a	2.	c	3.	c	4.	d
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4B

## ELEMENTS OF BIOLOGICAL IMPORTANCE

### Multiple Choice Questions

#### Entry Test Questions:

- Hydrogenation of unsaturated oils is done by using: (2011)
  - Finally divided nickel
  - Finally divided iron
  - Vanadium pentaoxide
  - Copper
- In contact process, the catalyst used for the conversion of Sulphur dioxide to Sulphur trioxide is: (2011)
  - Magnesium oxide
  - Aluminum oxide
  - Silicon dioxide
  - Vanadium pentoxide
- In the Haber's process for the manufacturing of ammonia, nitrogen is taken from: (2011)
  - Proteins occurring in living bodies
  - Ammonium salts obtained industrially
  - Air
  - Mineral containing nitrates
- In comparison with oxygen gas, a strong triple bond is present between two nitrogen atoms in a molecule and therefore nitrogen gas is: (2011)
  - Highly reactive gas
  - Completely inert like noble gases
  - Very less reactive gas
  - Moderately reactive gas
- In Contact Process for manufacturing sulphuric acid, Sulphur trioxide ( $\text{SO}_3$ ) is not absorbed in water because (2012)
  - The reaction does not go to completion
  - The reaction is highly exothermic
  - The reaction is quite slow
  - $\text{SO}_3$  is insoluble in water
- In modern Haber Process Plants, the temperature maintained during the process is (2012)
  - 670 – 770 K (400 °C – 500 °C)
  - 270 – 370 K (0 °C – 100 °C)
  - 370 – 470 K (100 °C – 200 °C)
  - 570 – 600 K (300 °C – 380 °C)
- In the Haber process for manufacturing of ammonia, Nitrogen is taken from: (2012)
  - Proteins occurring in living bodies
  - Ammonium salts obtained industrially
  - Air
  - Minerals containing nitrates
- The nature of an aqueous solution of ammonia ( $\text{NH}_3$ ) is: (2013)
  - Amphoteric
  - Neutral
  - Acidic
  - Basic
- In comparison with oxygen gas, a strong triple bond is present between two nitrogen atoms in a molecule and therefore nitrogen gas is: (2013)
  - Highly reactive gas
  - Completely inert like noble gases
  - Moderately reactive gas
  - Very less reactive gas
- The catalyst used in the Haber's process is: (2013)
  - Magnesium oxide
  - Aluminium oxide
  - Silicon oxide
  - Iron crystals with metal oxide promoters
- Which one of the following is correct equation of 1<sup>st</sup> ionization of sulphuric acid? (2013)
  - $\text{H}_2\text{SO}_{4(aq)} + \text{H}_2\text{O}_{(l)} \longrightarrow 2\text{H}^+ + \text{SO}_4^{2-}$
  - $\text{H}_2\text{SO}_{4(aq)} + \text{H}_2\text{O}_{(l)} \longrightarrow \text{H}^+_{(aq)} + \text{HSO}_4^-$
  - $\text{H}_2\text{SO}_{4(aq)} + \text{H}_2\text{O}_{(l)} \longrightarrow 2\text{H}^+ + \text{SO}_4^{2-}$
  - $\text{H}_2\text{SO}_{4(aq)} + \text{H}_2\text{O}_{(l)} \longrightarrow \text{H}_3\text{O}^+ + \text{SO}_4^{2-}$
- Which one of the following is the correct chemical reaction for Ammonia formation by Haber process? (2014)
  - $\text{N}_{2(g)} + 3\text{H}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$
  - $2\text{N}_{(g)} + 3\text{H}_{2(g)} \rightleftharpoons \text{NH}_{3(g)}$
  - $2\text{N}_{(g)} + 3\text{H}_{2(g)} \longrightarrow 2\text{NH}_{3(g)}$
  - $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$



13. Which one of the following products is obtained when sulphur trioxide is absorbed in concentrated sulphuric acid? (2014)
- (a) Oleum (b) Aqua Regia  
(c) Hydrogen sulphide (d) Sulphate ion
14. About 80% of ammonia is used for the production of (2015)
- (a) Explosives (b) Fertilizers  
(c) Nylon (d) Polymers
15. Urea is the most widely used nitrogen fertilizer in Pakistan. Its composition is: (2015)
- (a)  $\text{NH}_2\text{CO}$  (b)  $\text{N}_2\text{H}_5\text{CO}_2$   
(c)  $\text{N}_2\text{H}_4\text{CO}_2$  (d)  $\text{N}_2\text{H}_4\text{CO}$
16. During the manufacture of nitric acid, nitric oxide is oxidized to nitrogen dioxide. This reaction is given as: (2015)
- $$2\text{NO}_{(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{NO}_{2(g)} \Delta H = -114 \text{ kJ/mol}$$
- According to Le Chatelier's Principle
- (a) Reaction must not be temperature dependent  
(b) Reaction must be carried out at room temperature  
(c) Reaction must be carried out at low temperature  
(d) Reaction must be carried out at high temperature
17. What is the percentage of nitrogen in  $\text{NH}_3\text{NO}_3$ ? (2015)
- (a) 65% (b) 35%  
(c) 20% (d) 58%
18. The %age of nitrogen in ammonium nitrate is: (2016)
- (a) 46% (b) 82%  
(c) 33% (d) 13%
19. Which one of the following is anhydride of sulphuric acid? (2016)
- (a) Sulphur (II) oxide  
(b) Sulphur (IV) oxide  
(c) Iron pyrite  
(d) Sulphur (VI) oxide

20. During contact process of  $\text{SO}_3$ , the following reaction occurs:  
 $2\text{SO}_{2(g)} + \text{O}_2 \rightleftharpoons 2\text{SO}_{3(g)} \Delta H = -96 \text{ kJ/mol}$
- (a) Temperature is raised to very high degree  
(b)  $\text{SO}_3$  formed is removed very quickly  
(c) Both temperature and pressure are kept very low  
(d) An excess of air is used to drive the equilibrium to the right side
21. Synthesis of ammonia by Haber's process is a reversible reaction. What should be done to increase the yield of ammonium reaction? (2016)
- $$\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)} \Delta H = -92 \text{ kJ/mol}$$
- (a) Pressure should be decreased  
(b) Ammonia should remain in reaction mixture  
(c) Pressure should be increased  
(d) Concentration of nitrogen should be decreased

### Answers:

1.	a	2.	d	3.	c	4.	b
5.	b	6.	a	7.	c	8.	d
9.	d	10.	d	11.	b	12.	d
13.	a	14.	b	15.	d	16.	c
17.	b	18.	c	19.	d	20.	d
21.	c						

★ — ★ — ★

1C

## FUNDAMENTAL PRINCIPLES

### Multiple Choice Questions

#### Entry Test Questions:

1. The compound with an atom, which has unshared pair of electrons is called: (2011)
- (a) Nucleophile (b) Electrophile  
(c) Protophile (d) None of the above
2. 1-chloropropane and 2-chloropropane are isomers of each other, the type of isomerism in these two is called: (2011)
- (a) Cis-trans isomerism  
(b) Chain isomerism  
(c) Position isomerism  
(d) Functional group isomerism



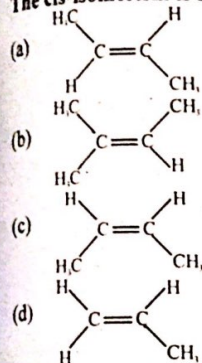
Ethene on polymerization, gives the product polyethene. This reaction may be called as: (2012)

- (a) Addition (b) Condensation  
(c) Substitution (d) Pyrolysis

In the following, which one is free radical? (2012)

- (a)  $\text{Cl}^-$  (b)  $\text{Cl}^+$   
(c)  $\text{Cl}_2$  (d)  $\text{Cl}^\bullet$

The cis-isomerism is shown by: (2013)



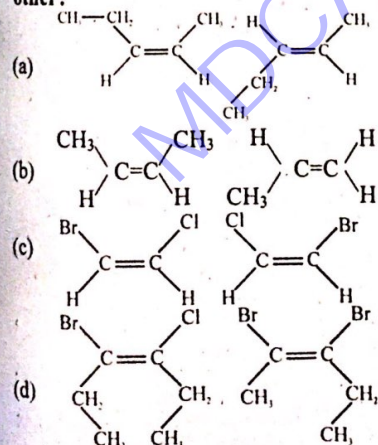
Select the nucleophile from the following examples: (2013)

- (a)  $\text{NO}_2$  (b)  $\text{NH}_3$   
(c)  $\text{NO}_2^+$  (d)  $\text{N}^+\text{H}_4$

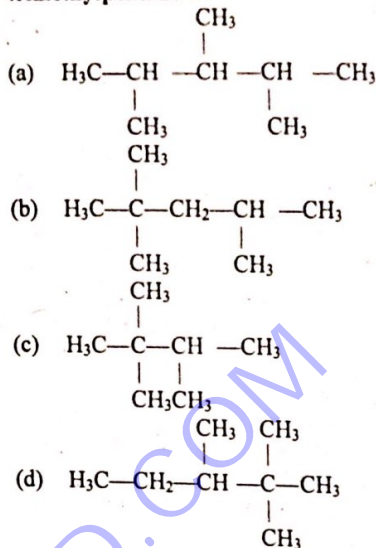
Which one of the following compound is a ketone? (2014)

- (a)  $\text{CH}_3 - \text{O} - \text{CH}_2 - \text{CH}_3$   
(b)  $\text{CH}_3 - \text{CO} - \text{CH}_2 - \text{CH}_3$   
(c)  $\text{CH}_3\text{COCOOH}$   
(d)  $\text{CH}_3 - \text{CH}_2\text{CHO}$

Which one of the following pair of compounds is cis and trans isomers of each other? (2014)



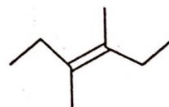
9. The structural formula of trimethylpentane is: (2015)



10. Which one of the following is a powerful electrophile used to attack on the electrons of benzene ring? (2015)

- (a)  $\text{FeCl}_2$  (b)  $\text{FeCl}_4^+$   
(c)  $\text{Cl}^+$  (d)  $\text{Cl}_2$

11. Skeletal formula of an organic compound is given below: (2016)



It is a hydrocarbon. IUPAC name of the compound is:

- (a) 3, 3-dimethyl-3-hexene  
(b) 3, 4-dimethyl-3-hexene  
(c) 3-hexene  
(d) 2,3-dimethyl-1-hexene

12. Which one of the following pairs can be cis-trans isomer to each other? (2016)

- (a)  $\text{CHCl}=\text{CCl}_2$  and  $\text{CH}_2=\text{CH}_2$   
(b)  $\text{CHCl}=\text{CH}_2$  and  $\text{CH}_2=\text{CHCl}$   
(c)  $\text{CH}_3\text{CH}=\text{CHCH}_3$  and  $\text{CH}_3\text{CH}=\text{CHCH}_3$   
(d)  $\text{CH}_3\text{CH}_3$  and  $\text{CH}_2=\text{CH}_2$



Answers:

1.	a	2.	c	3.	a	4.	d
5.	c	6.	b	7.	b	8.	a
9.	a	10.	c	11.	b	12.	c

★ — ★ — ★ —

2C

## HYDROCARBONS

### Multiple Choice Questions

#### Entry Test Questions:

1. Benzene in the presence of  $\text{AlCl}_3$  produces acetophenone when reacts with: (2011)  
(a) Acetyl chloride (b) Acetic acid  
(c) Ethyl benzene (d) Ethanoic acid
2. The substitution of a '-H' by '-NO<sub>2</sub>' group in benzene is called: (2011)  
(a) Nitration (b) Ammunolusis  
(c) Sulphonation  
(d) Reduction of benzene

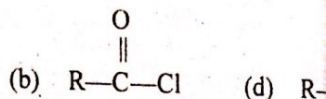
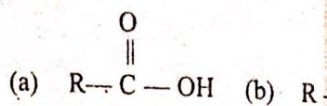
3. The introduction of  $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}^+$  group in benzene is called: (2012)

- (a) Acylation  
(b) Carbonyl reduction  
(c) Alkylation  
(d) Formylation

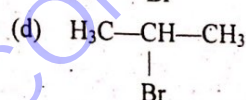
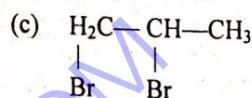
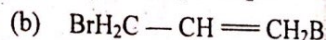
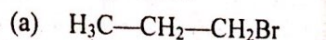
4. In the reaction of ethane with bromine the intermediate formed is: (2012)

- (a)  $\begin{array}{c} \text{H}_3\text{C} - \text{CH}_3 \\ \diagup \quad \diagdown \\ \text{Br} \end{array}$   
(b)  $\begin{array}{c} \text{H}_3\text{C} - \text{CH}_3 \\ | \\ \text{Br} \end{array}$   
(c)  $\begin{array}{c} \text{H}_3\text{C} - \text{CH}_3 \\ | \\ \text{Br} \end{array}$   
(d)  $\text{H}_2\text{C} = \text{CHBr}$

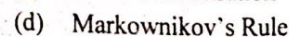
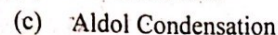
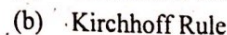
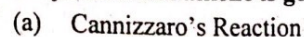
5. The introduction of an a benzene takes place in the pr and:



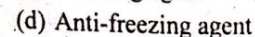
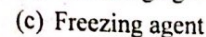
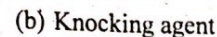
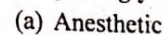
6. What is the product formed reacts with  $\text{HBr}$ ?



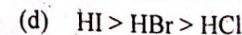
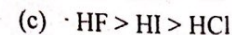
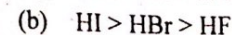
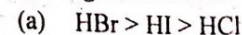
7. Addition of unsymmetrical unsymmetrical alkene is gove



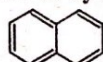
8. Ethylene glycols are used as:



9. Order of reactivity of hydrogen halide is:



10. The given three hydrocarbon



Benzene Naphthalene Anthracene

- (a) Alicyclic hydrocarbons  
(b) Aromatic hydrocarbons  
(c) Acyclic Hydrocarbons  
(d) Heterocyclic hydrocarbon

Which one of the following reactions shows combustion of a saturated hydrocarbon?

(2015)

- (a)  $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$   
 (b)  $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$   
 (c)  $CH_4 + \frac{1}{2} O_2 \xrightarrow[200 \text{ atm}]{400^\circ C, Cu} CH_3OH$   
 (d)  $C_2H_2 + \frac{5}{2} \rightarrow 2CO_2 + H_2O$

Answers:

1.	a	2.	a	3.	a	4.	a
5.	b	6.	d	7.	d	8.	d
9.	d	10.	b	11.	b		

—★—★—★—

## ALKYL HALIDES

### Multiple Choice Questions

#### Test Questions:

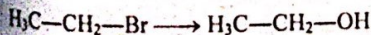
When purely alcoholic solution of sodium/potassium hydroxide and haloalkanes are reacted an alkene is formed, what is the mechanism of reaction? (2011)

- (a) Elimination (b) Dehydration  
 (c) Debromination  
 (d) Reduction of benzene

The organic compound carbon tetrachloride is used as: (2011)

- (a) Lubricant (b) Solvent  
 (c) Oxidant (d) Plastic

The alkaline hydrolysis of bromoethane shown below gives alcohol as the product: (2012)



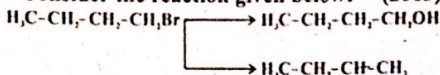
The reagent and the condition used in this reaction may be:

- (a)  $H_2O$  at room temperature  
 (b) Ethanol, heat  
 (c)  $KOH$  in alcohol  
 (d) Dilute  $NaOH_{(aq)}$  warm

4. In substitution reactions, dihaloalkane or secondary haloalkane give / show: (2012)

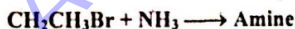
- (a)  $S_N1$  Mechanism  
 (b)  $S_N2$  Mechanism  
 (c) Both  $E_1$  and  $E_2$   
 (d) Both  $S_N1$  and  $S_N2$

5. Consider the reaction given below: (2013)



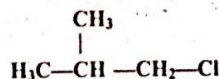
Which statement is true?

- (a) Reagent for I is  $KOH$  in alcohol  
 (b) Reagent for II is  $KOH$  in aqueous medium  
 (c) Reaction I is Debromination  
 (d) Reaction II is elimination
6. If haloalkanes are mixed with an excess of ethanoic ammonia and heated under pressure, amine are formed. Which amine is formed in the following reaction? (2014)



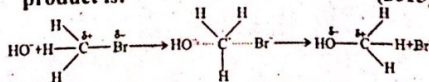
- (a)  $CH_3-CH_2-NH-CH_2-CH_3$   
 (b)  $CH_3-CH_2-NH_2$   
 (c)  $CH_3-CH_2-CH_2-NH_2$   
 (d)  $H_2N-CH_2-CH_2-NH_2$

7. The IUPAC name of the given compound is: (2015)



- (a) 1-Chloro-2-methylpropane  
 (b) 1-Chloro-2-methylbutane  
 (c) Isobutyl chloride  
 (d) 2-Methyl-3-chloropropane

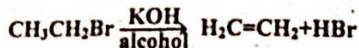
8. In the below reaction, the configuration of product is: (2015)



- (a) 100% same of the configuration of reactant  
 (b) 50% retained  
 (c) 50% inverted  
 (d) 100% opposite from configuration of reactant



9. Consider the reaction given below: (2016)



Mechanism followed by the reaction is:

- (a)  $\text{E}_2$  (b)  $\text{E}_1$   
 (c)  $\text{S}_{\text{N}}1$  (d)  $\text{S}_{\text{N}}2$
10. Which one of the following is NOT a nucleophile: (2016)
- (a)  $\text{NH}_2^-$  (b)  $\text{H}_2\text{O}$   
 (c)  $\text{BF}_3$  (d)  $\text{CH}_3^-$

Answers:

1.	a	2.	b	3.	d	4.	d
5.	d	6.	b	7.	a	8.	d
9.	a	10.	c				

—★—★—★—

4C

## ALCOHOLS AND PHENOLS

### Multiple Choice Questions

#### Entry Test Questions:

1. An alcohol is converted to an aldehyde with same number of carbon atoms as that of alcohol in the presence of  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ , the alcohol is: (2011)

- (a)  $\text{CH}_3\text{Cl}(\text{CH})_2\text{OH}$   
 (b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$   
 (c)  $(\text{CH}_3)_3\text{COH}$   
 (d)  $(\text{CH}_3)_3\text{CHOH}$

Which of the following is a secondary alcohol? (2011)

- (a)  $\text{H}_3\text{C}-\underset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{OH}$   
 (b)  $\text{H}_3\text{C}-\text{CH}_2-\text{CH}_2-\text{OH}$   
 (c)  $\text{H}_3\text{C}-\underset{\text{CH}_3}{\underset{|}{\text{CH}}}-\text{CH}_2-\text{OH}$   
 (d)  $\text{H}_3\text{C}-\underset{\text{CH}_3}{\underset{|}{\text{CH}}}-\underset{\text{OH}}{\underset{|}{\text{CH}}}-\underset{\text{CH}_3}{\underset{|}{\text{C}}}-\text{CH}_3$

3. Which enzyme is involved in the fermentation of glucose: (2011)

- (a) Zymase (b) Invertase  
 (c) Urease (d) Diastase

4. Relative acidic strength of alcohol, phenol and carboxylic acid is: (2011)

- (a) Carboxylic acid > Alcohol > Phenol  
 (b) Carboxylic acid > Phenol > Alcohol  
 (c) Phenol > Carboxylic acid > Alcohol  
 (d) Water > Alcohol > Phenol

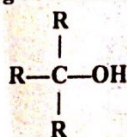
5. The dehydration of ethyl alcohol with concentrated  $\text{H}_2\text{SO}_4$  at  $140^\circ\text{C}$  gives: (2011)

- (a) Ethene (b) Diethyl ether  
 (c) Alcohol (d) Carboxylic acid

6. Ethanol can be converted into ethanoic acid by: (2011)

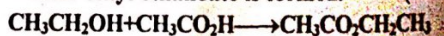
- (a) Oxidation (b) Fermentation  
 (c) Hydration (d) Hydrogenation

7. The following structure is of: (2011)



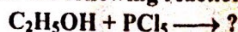
- (a) Secondary alcohol  
 (b) Primary alcohol  
 (c) Tertiary alcohol  
 (d) Carboxylic acid

8. When ethanol is warmed with ethanoic acid in the presence of strong acid catalyst, an ester ethyl ethanoate is formed. (2011)



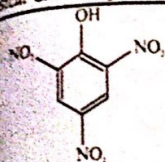
- (a) Alcohol is reduced  
 (b) O-H bond in ethanoic acid is broken  
 (c) O-H bond in ethanol is broken  
 (d) Acid is oxidized

9. Consider the following reaction: (2011)



What product(s) may be formed?

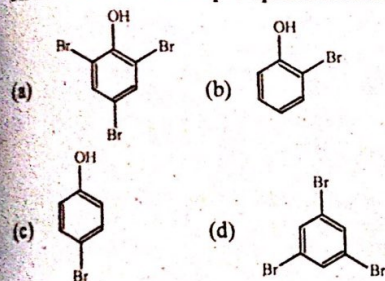
- (a)  $\text{C}_2\text{H}_5\text{Cl}$  only  
 (b)  $\text{C}_2\text{H}_5\text{Cl}$  and  $\text{HCl}$   
 (c)  $\text{C}_2\text{H}_5\text{Cl}$ ,  $\text{POCl}_3$  and  $\text{HCl}$   
 (d)  $\text{C}_2\text{H}_5\text{Cl}$  and  $\text{POCl}_3$



is named as: (2013)

- (a) Picric acid
- (b) Nitro phenol
- (b) Benzoic acid
- (c) Malonic acid

Aqueous phenol decolorizes bromine water to form a white precipitate. What is the structure of the white precipitate formed?



2. The relative strength of carboxylic acid, water, ethanol and phenol has the following order of increasing acid strength:

- (a) Carboxylic Acid > Phenol > Ethanol > Water
- (b) Carboxylic Acid > Phenol > Water > Ethanol
- (c) Phenol > Carboxylic Acid > Ethanol > Water
- (d) Water > Ethanol > Phenol > Carboxylic Acid

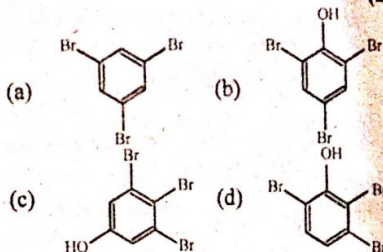
3. Primary, secondary and tertiary alcohols can be identified and distinguished by

- (a) Lucas test
- (b) Iodoform test
- (c) Baeyer's test
- (d) Silver mirror test

4. Which one of the following alcohol is indicated by formation of yellow crystals in iodoform test? (2014)

- (a) Methanol
- (b) Ethanol
- (c) Butanol
- (d) Propanol

15. The formula of 2, 4, 6-tribromo phenol is: (2014)



16. Which one of the following groups is indicated when HCl is formed by reaction of  $\text{C}_2\text{H}_5\text{Cl}$  with phosphorous pentachloride? (2014)

- (a) Amino group
- (b) Hydroxyl group
- (c) Halide group
- (d) Hydride group

17. Which one of the following was used as one of the earliest antiseptic and disinfectant? (2015)

- (a) Phenol
- (b) Ether
- (c) Ethanol
- (d) Methanol

18. Which one of the following is NOT able to denature the ethanol? (2015)

- (a) Methanol
- (b) Lactic acid
- (c) Pyridine
- (d) Acetone

19. How will you distinguish between methanol and ethanol? (2015)

- (a) By Lucas test
- (b) By silver mirror test
- (c) By oxidation
- (d) By Iodoform test

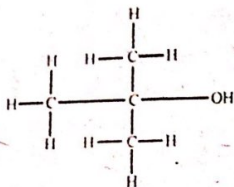
20. To produce absolute alcohol (100%) from rectified spirit (95.6% alcohol), the remaining 4.4% water must be removed by a drying agent such as: (2015)

- (a) Calcium oxide
- (b) Calcium chloride
- (c) Calcium carbonate
- (d) Carbon monoxide

21. Which one of the following is an appropriate indication of positive iodoform test? (2016)

- (a) Formation of  $\text{H}_2\text{O}$
- (b) Release of  $\text{H}_2$  gas
- (c) Brick red precipitate
- (d) Yellow crystal

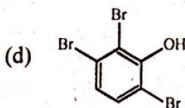
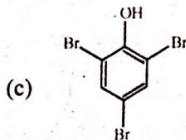
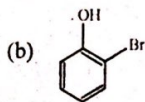
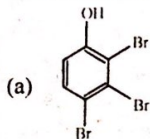




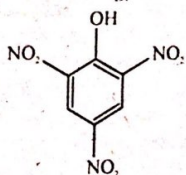
Which one of the following is the proper classification of above formula:

- (a) Primary (b) Secondary  
(c) Tertiary (d) Polyhydride

23. Which one of the following is an appropriate structure of product of bromination of phenol? (2016)



24.



Which one of the following is an appropriate name of above compound? (2016)

- (a) 1,3,6-Trinitrophenol  
(b) m-Nitrophenol  
(c) Tartaric acid (d) Picric acid

Answers:

1.	b	2.	a	3.	a	4.	b
5.	b	6.	a	7.	c	8.	c
9.	c	10.	a	11.	a	12.	b
13.	a	14.	b	15.	b	16.	b
17.	a	18.	b	19.	d	20.	a
21.	d	22.	c	23.	c	24.	d

★ ★ ★

5C

## ALDEHYDES AND KETONES

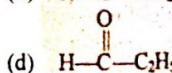
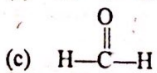
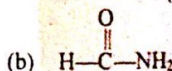
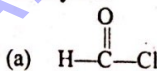
### Multiple Choice Questions

#### Entry Test Questions:

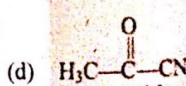
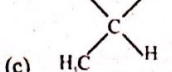
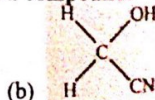
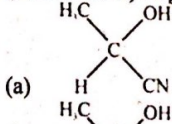
1. Consider the following reaction: (2011)  
 $R-CHO + 2[Ag(NH_3)_2]OH \rightarrow R-COONH_4 + 2Ag + 2NH_3 + H_2O$   
 This reaction represents one of the following tests.  
 (a) Fehling test (b) Benedict test  
 (c) Ninhydrin test (d) Tollens test
2. In the below reaction, the nucleophile is: (2011)



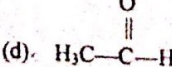
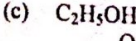
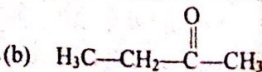
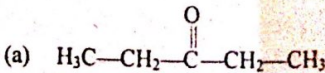
- (a)  $CN^-$  (b)  $HCl$   
 (c)  $Cl^-$  (d)  $OH^-$
3. Which one of the following compound belongs to the homologous series of aldehydes? (2011)



4. Formaldehyde reacts with  $HCN$  ( $NaCN+HCl$ ) to give a compound: (2012)



5. Iodoform test will not be positive with: (2012)



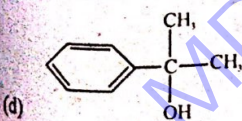
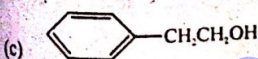
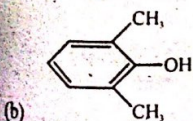
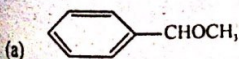
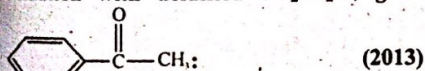
When  $\text{CH}_3\text{CH}_2\text{OH}$  is oxidized in the presence of  $\text{K}_2\text{Cr}_2\text{O}_7$  and  $\text{H}_2\text{SO}_4$ , the product formed is: (2012)

- (a)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$  (b)  $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$   
 (c)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$  (d)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OCH}_3$

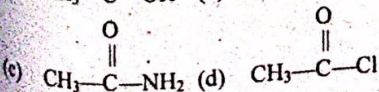
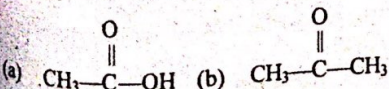
Which group gives a yellow precipitate of triiodo methane when warmed with alkaline aqueous iodine? (2013)

- (a) An amide group,  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$   
 (b) Entyl Ketone group,  $\text{C}_2\text{H}_5-\overset{\text{O}}{\parallel}{\text{C}}-\text{R}$   
 (c) A primary Alcohol group as in Propanol  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{OH}$   
 (d) Methyl Ketone group,  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{R}$

What is the structure of alcohol which on oxidation with acidified  $\text{Na}_2\text{Cr}_2\text{O}_7$  gives



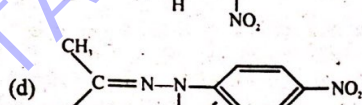
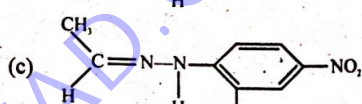
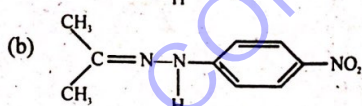
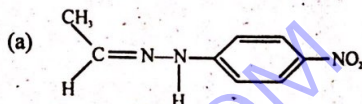
Which of the following is the structure of ketone? (2013)



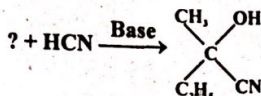
10. A student mixed ethyl alcohol with small amount of sodium dichromate and added it to the hot solution of dilute sulphuric acid. A vigorous reaction took place. He distilled the product formed immediately. What was the product? (2014)

- (a) Acetone (b) Acetic acid  
 (c) Dimethyl ether (d) Acetaldehyde

11. The structural formula of the product of reaction of acetone with 2, 4-dinitrophenyl hydrazine is: (2014)



12. For the reaction: (2014)



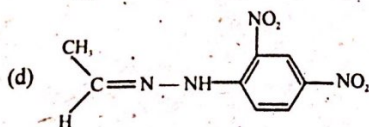
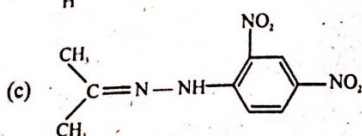
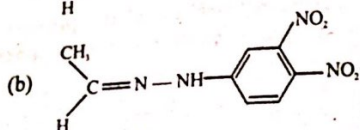
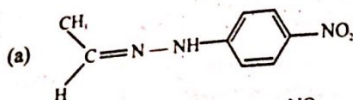
- (a)  $\text{C}_2\text{H}_5\text{COCH}_3$   
 (b)  $\text{C}_2\text{H}_5\text{CH}(\text{CH}_3)\text{OH}$   
 (c)  $\text{CH}_3\text{COCH}_3$   
 (d)  $\text{C}_2\text{H}_5\text{CH}_2\text{CHO}$

13. Which one of the following is also called silver mirror test? (2015)

- (a) Fehling's solution test  
 (b) Iodoform test  
 (c) Tollen's reagent  
 (d) Benedict's solution tests



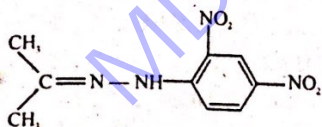
14. When acetaldehyde reacts with 2,4-dinitrophenylhydrazine (2,4-DNPH), which one of the following products is formed? (2015)



5. Both aldehydes and ketones are planer to the neighborhoods of carbonyl ( $C=O$ ) group. Which one of the following bonds is distorted towards the oxygen atoms? (2015)

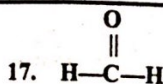
- (a)  $\pi$ -bond of C and O  
(b) Sigma bond of C and H  
(c) Sigma bond of C and O  
(d) Sigma bond of C and C

(2016)



It is the general formula of:

- (a) 2, 4-Dinitrophenyl hydrazine  
(b) 1, 3-Dinitrophenyl hydrazone  
(c) Phenyl hydrazone  
(d) 2, 4-Dinitrophenyl hydrazone



Which one of the following is the IUPAC name of above given structure: (2016)

- (a) Propionaldehyde  
(b) Methanone  
(c) Acetaldehyde  
(d) Methanal

18. Which one of the following test is given by both aldehyde and ketone? (2016)

- (a) Silver mirror test  
(b) Fehling's solution test  
(c) 2, 4 DNPH test  
(d) Benedict's solution test

Answers:

1.	d	2.	a	3.	c	4.	b
5.	a	6.	a	7.	d	8.	a
9.	b	10.	d	11.	d	12.	a
13.	c	14.	d	15.	a	16.	d
17.	d	18.	c				

6C

## CARBOXYLIC ACIDS

### Multiple Choice Questions

#### Entry Test Questions:

1.  $\text{CH}_3\text{COOH} + \text{PCl}_5 \longrightarrow ?$  (2011)

The products of the above reaction are:

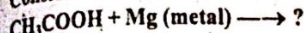
- (a)  $\text{CH}_3\text{COI} + \text{POCl}_3 + \text{HCl}$   
(b)  $\text{CH}_3\text{COI} + \text{POCl}_2 + \text{HCl}$   
(c)  $\text{CH}_3\text{Cl} + \text{POCl}_3 + \text{HCl}$   
(d)  $\text{CH}_3\text{COCl} + \text{POCl}_3 + \text{H}_2$

2.  $\text{CH}_3\text{CN} + \text{HCl} \longrightarrow \text{A} + \text{B}$  (in the presence of water) (2011)

In the above reaction, A and B are:

- (a) Acetic acid and acid amide  
(b) Acetic acid and ammonia  
(c) Acetic acid and methyl chloride  
(d) Acetic acid and ammonium chloride

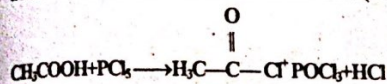
Consider the following reaction: (2011)



What product will form?

- (a) Magnesium formate
- (b) Magnesium acetate
- (c) Magnesium ion
- (d) Carboxylate ion

In the below reaction the nucleophile which attacks on the carbon atom of acid is: (2012)



- (a)  $\text{OH}^-$
- (b) P
- (c)  $\text{Cl}^-$
- (d)  $\text{H}^-$

When ethanol chloride reacts with methylamine, an amide is formed. What is the structure of the amide formed? (2012)

- (a)  $\text{H}_3\text{C}-\text{CH}_2-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2$
- (b)  $\text{H}_3\text{C}-\text{CH}_2-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NHCH}_3$
- (c)  $\text{H}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2$
- (d)  $\text{H}_3\text{C}-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NHCH}_3$

Primary alcohols normally give us aldehydes when oxidized in the presence of  $\text{Na}_2\text{Cr}_2\text{O}_7$ , what the product will be, when the secondary alcohols are oxidized in same conditions? (2012)

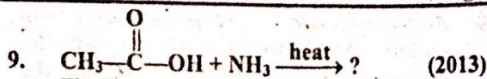
- (a) Alkenes
- (b) Alkynes
- (c) Alkyl halides
- (d) Ketones

The formation of ester from acetic acid in presence of acid and ethanol is a: (2013)

- (a) Nucleophilic substitution reaction
- (b) Nucleophilic addition reaction
- (c) Electrophilic substitution reaction
- (d) Electrophilic addition reaction

Methyl cyanides, on boiling with mineral acids or alkalis yield: (2013)

- (a) Acetic acid
- (b) Formic acid
- (c) Propanoic acid
- (d) Butanoic acid



The final products formed are:

- (a)  $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2 + \text{CO}_2$
- (b)  $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2 + \text{H}_2\text{O}$
- (c)  $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2 + \text{H}_2$
- (d)  $\text{CH}_3-\overset{\text{O}}{\underset{\parallel}{\text{C}}}-\text{NH}_2 + \text{HCl}$

10. Ethyl butyrate and butyl butanoate are esters with the flavor of: (2014)

- (a) Pear
- (b) Banana
- (c) Pineapple
- (d) Apple

11. Acetamide is formed by dehydration of: (2014)

- (a) Oxalic acid
- (b) Ethanoic acid
- (c) Butanoic acid
- (d) Propanoic acid

12. Organic compounds 'X' and 'Y' both can react with Na-Metal to evolve hydrogen gas. If 'X' and 'Y' react with each other form an organic compound 'Z' which gives fruity smell. What type of compound 'X', 'Y' and 'Z' are? (2014)

	X	Y	Z
a)	Alcohol	Ester	Acetic
b)	Alcohol	Ester	Mineral
c)	Alcohol	Acetic	Ester
d)	Alcohol	Mineral	Ester

13.  $K_a$  values of few organic acids are given: (2015)

Acid	$K_a$ Value
$\text{CH}_3\text{COOH}$	$1.85 \times 10^{-5}$
$\text{CCl}_3\text{COOH}$	$2.3 \times 10^{-2}$
$\text{CHCl}_2\text{COOH}$	$5.0 \times 10^{-3}$
$\text{CH}_2\text{ClCOOH}$	$1.3 \times 10^{-3}$

The order of acid strength is:

- (a)  $\text{CCl}_3\text{COOH} > \text{CHCl}_2\text{COOH} > \text{CH}_2\text{ClCOOH} > \text{CH}_3\text{COOH}$
- (b)  $\text{CH}_3\text{COOH} > \text{CHCl}_2\text{COOH} > \text{CCl}_3\text{COOH} > \text{CH}_2\text{ClCOOH}$
- (c)  $\text{CHCl}_2\text{COOH} > \text{CH}_3\text{COOH} > \text{CCl}_3\text{COOH} > \text{CH}_2\text{ClCOOH}$
- (d)  $\text{CCl}_3\text{COOH} > \text{CH}_3\text{COOH} > \text{CHCl}_2\text{COOH} > \text{CH}_2\text{ClCOOH}$



14. An organic acid 'z' reacts separately with sodium bicarbonate, sodium hydroxide and sodium carbonate. Which one of the following represent the structure of 'z'? (2015)

- (a)  $\text{HCOOC}_2\text{H}_5$   
 (b)  $\text{CH}_3-\text{CH}=\text{CH}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{OH}$   
 (d)  $\text{H}_3\text{C}-\text{CH}_2-\text{COOH}$

15. Carboxylic acids are rather hard to reduce, which powerful reducing agent can be used to convert them to the corresponding primary alcohol: (2015)

- (a)  $\text{H}_2\text{SO}_4/\text{HgSO}_4$   
 (b)  $\text{V}_2\text{O}_5$   
 (c)  $\text{LiAlH}_4$   
 (d)  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$

16.  $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$  (2016)

Which one of the following will act as a catalyst in above reaction?

- (a)  $\text{HNO}_3$  (b)  $\text{H}_2\text{SO}_4$   
 (c) Acidified potassium dichromate  
 (d)  $\text{SOCl}_2$

17.  $\text{CH}_3\text{COOH} + \text{PCl}_5 \rightarrow ?$  (2016)

Which one of the following options shows the products of above reaction?

- (a)  $\text{POCl}_2 + \text{CH}_3\text{COCl}_2 + \text{HCl}$   
 (b)  $\text{CH}_3\text{COCl} + \text{POCl}_2 + \text{HCl}$   
 (c)  $\text{POCl}_3 + \text{CH}_3\text{COCl}_2 + \text{H}_2$   
 (d)  $\text{POCl}_3 + \text{CH}_3\text{COCl} + \text{HCl}$

18. Which one of the following reaction of carboxylic acid is reversible? (2016)

- (a) Esterification  
 (b) Salt formation  
 (c) Reaction with  $\text{PCl}_5$   
 (d) Reaction with  $\text{SOCl}_2$

Answers:

1.	a	2.	d	3.	b	4.	c
5.	d	6.	d	7.	a	8.	a
9.	b	10.	c	11.	b	12.	c
13.	a	14.	d	15.	c	16.	b
17.	d	18.	a				

—★—★—★—

7C

## AMINO ACIDS

Chapter Excluded

—★—★—★—

8C

## MACROMOLECULES

Chapter Excluded

—★—★—★—

9C

## ENVIRONMENTAL CHEMISTRY

Chapter Excluded

—★—★—★—